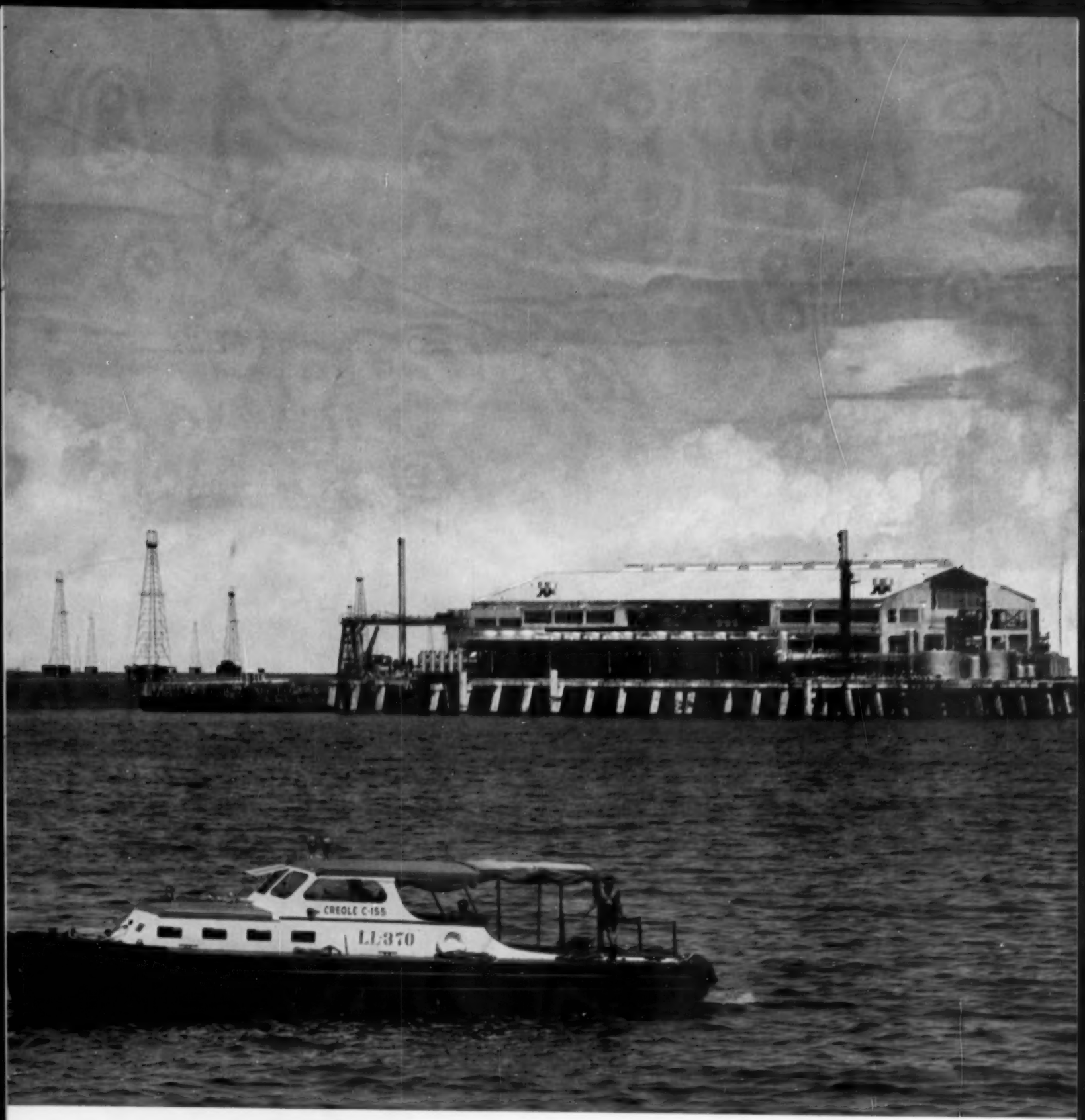



FIVE DOLLARS PER YEAR

APRIL 1955

ONE DOLLAR PER COPY

# WORLD PETROLEUM

25 YEARS OF SERVICE TO THE INTERNATIONAL PETROLEUM INDUSTRY

Levi Reynolds, Cameron's Division Manager, Oklahoma Division

## CAMERON QUALITY IN A FULL RANGE OF XMAS TREES

The same quality that has distinguished Cameron in the field of high pressure control is also available in low pressure equipment. Choose from numerous proven types of pipe suspension and seal. Enjoy the added benefit of forged alloy steel well heads, and the undivided responsibility that goes with the **All-Cameron** tree.

**Cameron**
**IRON WORKS, INC.**

Export Office: 7912 Empire State Bldg., New York City. In England: British Oilfield Equipment Co., Ltd., Time & Life Bldg., New Bond Street, London W. 1 England.

# Unique

"Newallastic" bolts and studs have qualities which are absolutely unique. They have been tested by every known device, and have been proved to be stronger and more resistant to fatigue than bolts or studs made by the usual method.

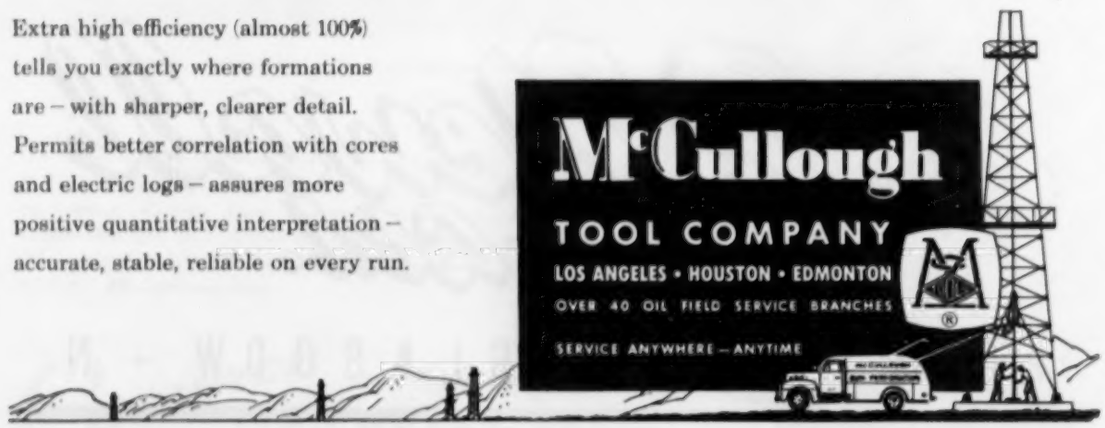
## C. P. Newall & Co., Ltd.

POSSILPARK GLASGOW · N

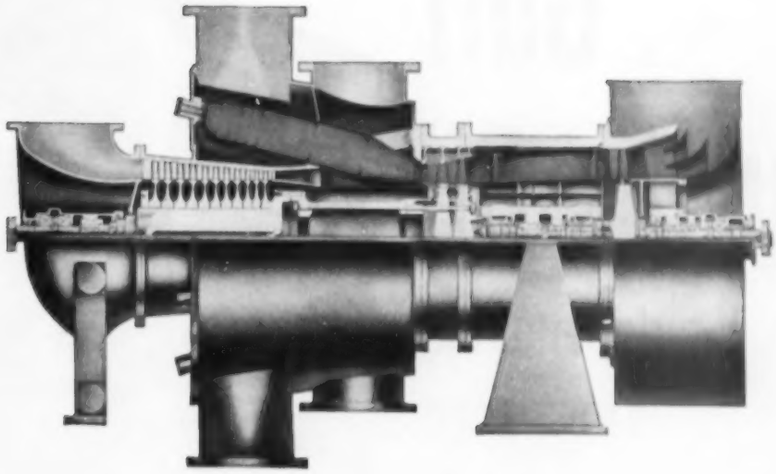
*locates formations of interest*
*with "pin-point" accuracy*

# McCullough
# RADIATION WELL LOGGER
## with SCINTILLOMETER® (Gamma Ray and Neutron Logs)

Extra high efficiency (almost 100%) tells you exactly where formations are – with sharper, clearer detail. Permits better correlation with cores and electric logs – assures more positive quantitative interpretation – accurate, stable, reliable on every run.




WORLD PETROLEUM for April, 1955. Vol. 26, No. 4, April, 1955. WORLD PETROLEUM is published monthly by Mona Palmer, Trustee under the will of Russell Palmer, 604 Fifth Ave., New York 20, N.Y. Authorized as Second Class Matter, P.O. Dept., Ottawa, Canada. Subscription rate: $5.00 per year, single copies $1.00. Copyright 1955, by Mona Palmer, Toronto.



# *What's in it* FOR YOU?

You're looking at a cut-away view of a Westinghouse 5000-hp gas turbine. This is one in a complete line of Westinghouse gas turbines, ranging from 1800 hp (1250 kw) to 20,000 hp (15,000 kw), which are providing more economical power for industry throughout the world.

In eastern Venezuela, for example, Westinghouse gas turbine-generators are turning natural gas into *power* for oil fields of the Mene Grande Oil Company. And in Spain, another unit, because of simplicity of installation and operation as well as quick availabi'ity, will soon permit a leading metal rolling mill to go to a continuous work week despite local power shortages.

Can the Westinghouse gas turbine help *you?*

*Yes, it can,* if . . .

- Water is scarce
- Or natural gas is readily available
- Or you need a pipeline pumping or quickly-operable stand-by power generation unit
- Or you can use exhaust gas for feed heating, steam generation or process
- Or you need additional installed capacity quickly.

For more information on the Westinghouse gas turbine and its applicability to your needs, write to me on your company letterhead for one or both booklets: BW-5859, Gas Turbines for Mechanical Drive Applications; BW-5887, Gas Turbines for Electric Power Generation.

N. F. Emig

N. F. Emig, *Supervisor*
Steam Section

YOU CAN BE SURE
. . . IF IT'S

**Westinghouse**

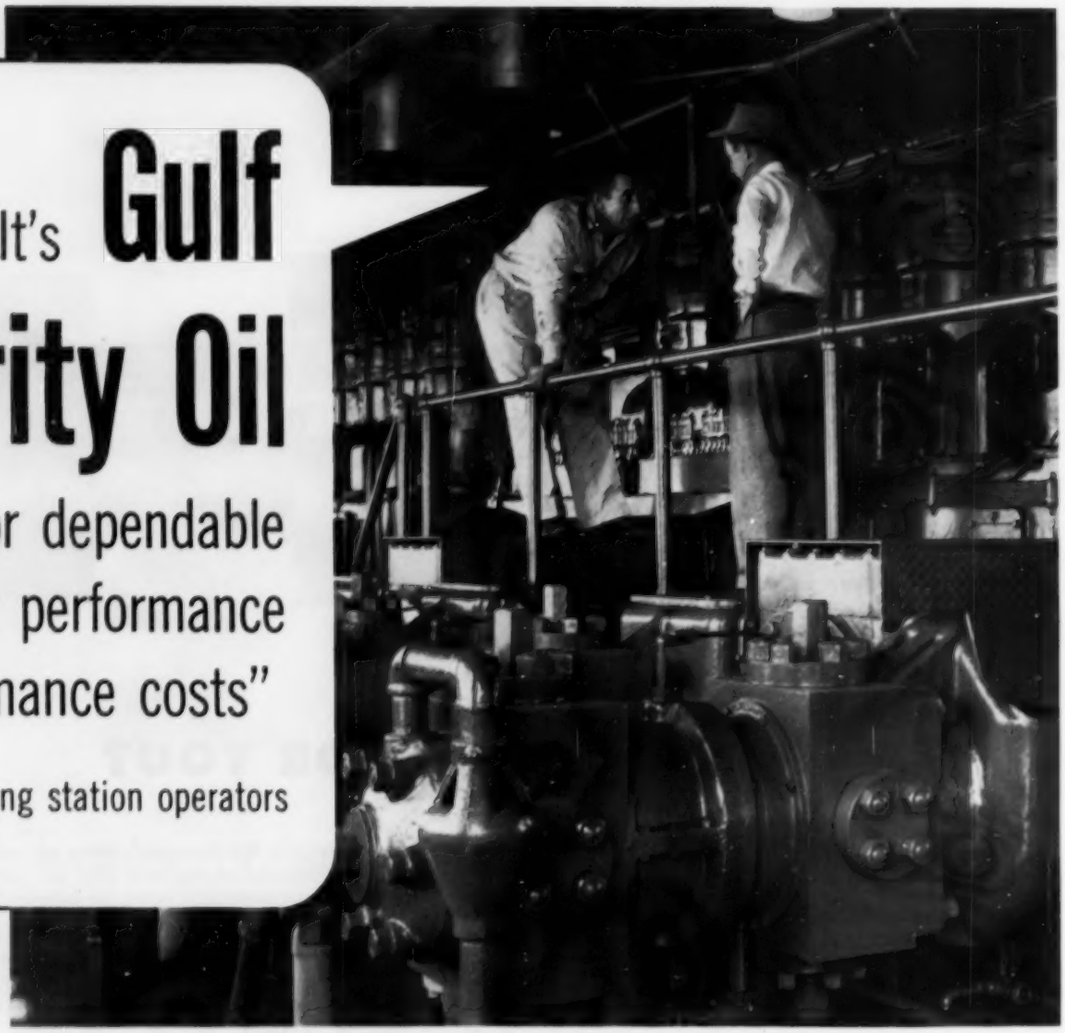
WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY
40 Wall Street • New York 5, U.S.A.

"It's **Gulf**

# Security Oil

for dependable
gas compressor performance
and low maintenance costs"

say pumping station operators



Smooth, continuous operation is a must for these units in service at a South Texas gas compressor plant. They are responsible for the steady flow of essential natural gas through pipe lines to homes and industries as far north as Detroit and New York. Gulf Security Oil provides the sure, effective protection needed for cylinders and bearings in both engines and compressors.

You can depend on Gulf Security Oil to provide the proper lubrication that is so important to vital compressor units if operating troubles are to be prevented and maintenance costs kept low.

Gulf Security Oil has a record of outstanding performance in scores of gas transmission plants. After years of operation with this quality oil, the cylinders and piston rings of both the compressors and power assemblies show negligible wear. And few carbon deposits have formed on power cylinder ports and pistons.

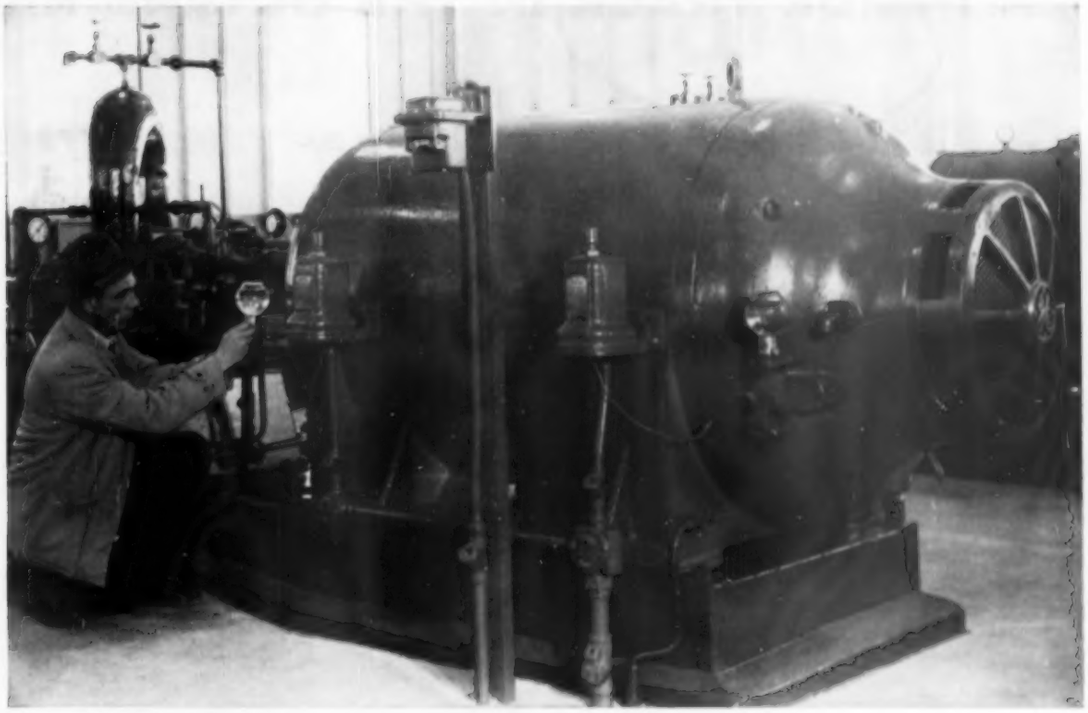
If you are installing new compressor units, or feel that you're not getting the most effective lubrication possible for your present units, it will certainly pay you to try Gulf Security Oil. Contact your nearest Gulf Office and have a Gulf Sales Engineer call.

**Gulf Oil Corporation • Gulf Refining Company**
1822 GULF BUILDING, PITTSBURGH 30, PENNSYLVANIA

GULF

*The finest petroleum products for your every need*

# G-E Reports On Electrical Developments . . . No. 20



## G-E CUTS PLANNING TIME, SPEEDS INSTALLATION AT TWO NEW PUMPING STATIONS

**BACKGROUND.** Maximum safety precautions, minimum maintenance, high functional dependability . . . these were specified as "musts" for the electric equipment in two new pumping stations of the Buckeye Pipeline Co., in Pennsylvania, U.S.A.

**PROJECT CO-ORDINATION.** Working closely with Buckeye's engineers and consultants, General Electric Application Engineers helped develop a co-ordinated electrical system that met all the specifications economically. And G-E Field Engineers, on hand for the installation, helped speed a smooth start-up.

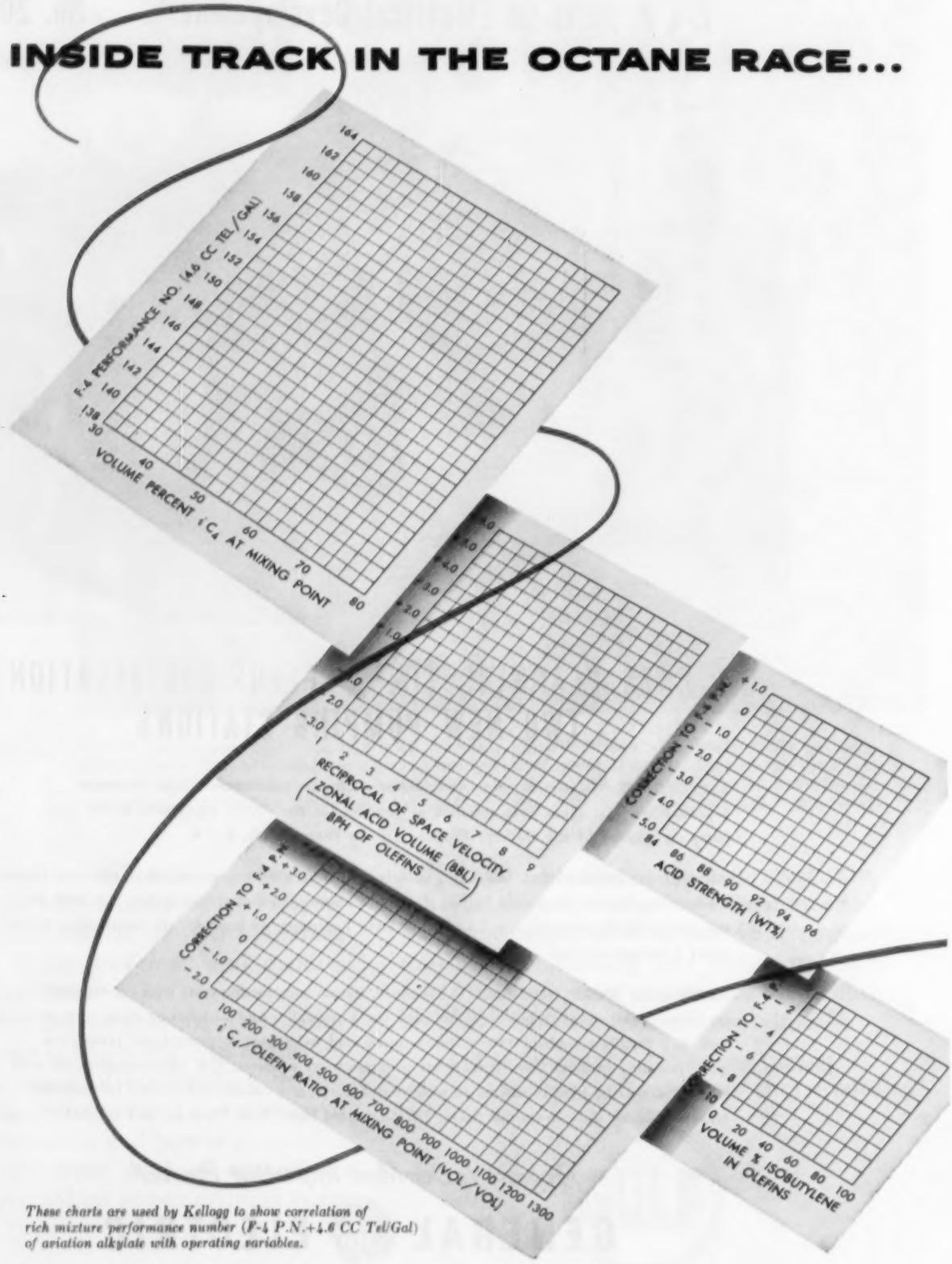
**KNOW-HOW WORKS FOR YOU.** At Buckeye, station construction costs were cut because G-E explosion-proof motors eliminated the need for a firewall. And installation costs were reduced, with G-E factory-assembled 3300-v indoor metal-clad switchgear to control and protect the main pumping motors. No matter what your electrical problem, G-E representatives all over the world will be glad to discuss it with you. See the one nearest you today. *International General Electric Co., Industrial Sales, 570 Lexington Ave., New York 22, N.Y., U.S.A.* 18-55-5R

*Progress Is Our Most Important Product*

GENERAL ELECTRIC

-U.S.A.-

# INSIDE TRACK IN THE OCTANE RACE...


F-4 PERFORMANCE NO. (4.6 CC TEL/GAL)
VOLUME PERCENT i C4 AT MIXING POINT
RECIPROCAL OF SPACE VELOCITY (ZONAL ACID VOLUME (BBL) / BPH OF OLEFINS)
CORRECTION TO F-4 P.N.
ACID STRENGTH (WT%)
i C4/OLEFIN RATIO AT MIXING POINT (VOL/VOL)
VOLUME % ISOBUTYLENE IN OLEFINS

*These charts are used by Kellogg to show correlation of rich mixture performance number (F-4 P.N.+4.6 CC Tel/Gal) of aviation alkylate with operating variables.*

# Kellogg Alkylation

## -INVESTMENT PAYOUT IN ONE YEAR!

A quick way to higher octane ratings at lowest operating and investment costs is sulfuric acid alkylation—utilizing Kellogg's unique cascade reactor and auto-refrigeration system.

Providing exceptionally high yields of superior alkylate, this Kellogg process sharply reduces the cost of the isobutane recycling equipment; maintains acid consumption at the lowest possible level; assures efficient mixing in reaction sections at low horsepower.

The accompanying co-ordinates demonstrate a few of the variables confronting the alkylate process engineer. The curves of these co-ordinates have been worked out through Kellogg research and experience, and the design results are available to refiners planning new alkylate capacity.

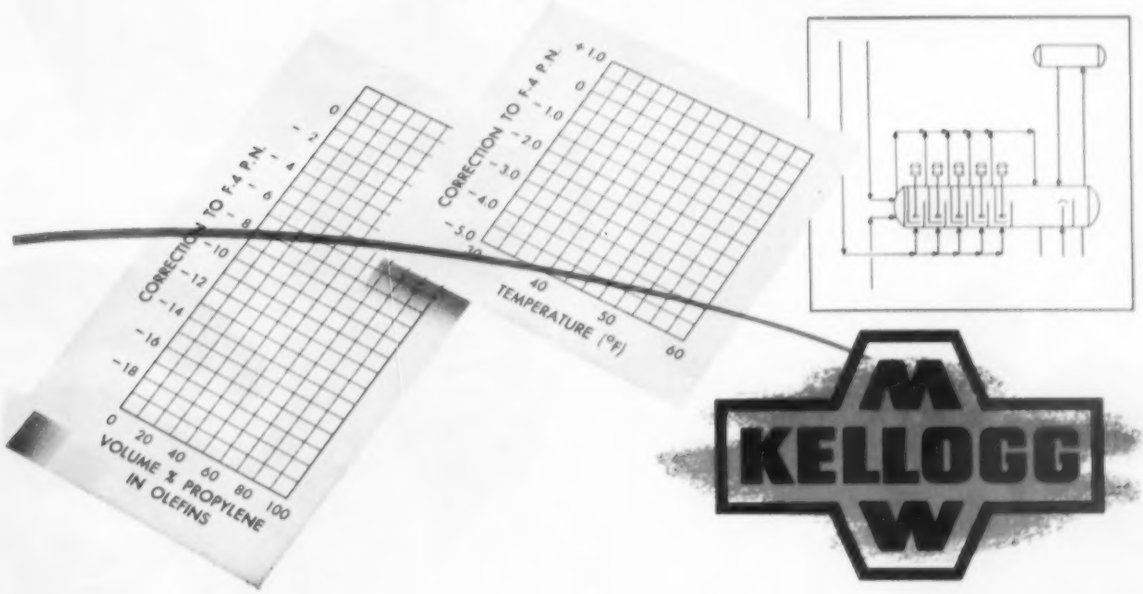
An example of what Kellogg alkylation can do in attaining premium results working with various blending components is provided by a recent study undertaken by Kellogg engineers of a proposed new 25,000 BPSD refinery on the Gulf Coast. Here, alkylation of total $C_3$ and $C_4$ olefins, assuming extraneous isobutane available at nominal price, results in the production of 15 volume percent on crude of high octane alkylate, with a payout on incremental investment over a base case of well under one year.

A comparable study of incremental alkylation not requiring extraneous isobutane, but compared with a base case incorporating non-selective catalytic polymerization, shows a payout of just over a year. Under these conditions alkylate production amounts to 6 volume percent on crude, and the combined alkylate plus catalytic polymer to slightly over 9 volume percent.

**REFINERY PROCESS DIVISION, THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK 7, N. Y.**

*In Canada: The Canadian Kellogg Company, Limited, Toronto. In Europe: Kellogg International Corporation, London*

SUBSIDIARIES OF PULLMAN INCORPORATED



# Oil Men In White...

Saudi Arabs hold down many important jobs at the Arabian American Oil Company's big, modern Health Center in Dhahran, Saudi Arabia. They studied long and hard at ARAMCO schools and now their training is paying off.

**Aramco**

ARABIAN AMERICAN OIL CO.
Dhahran, Saudi Arabia  New York, N.Y., U.S.A.

CAPOSITE-insulated pipe-lines at the Anglo-Iranian Oil Co's Kent Oil Refinery.

# we've a long FIBRED start!

As compared with other forms of asbestos insulation, CAPOSITE enjoys one very considerable advantage. This is in the matter of fibre-length — a key factor in the thermal efficiency of all asbestos materials. CAPOSITE is made from the uniquely long-fibred type of asbestos known as *amosite*, obtained from The Cape Asbestos Co's own mines. This extra length of fibre gives it a long start, both in thermal efficiency and in other important respects as well; in greater durability, for example, without any corresponding excess of weight. CAPOSITE is available in moulded form to suit the contour of the surface to be insulated. It is easily applied, combining lightness in weight with exceptional strength and durability. CAPOSITE Insulations are designed for use up to 1,000°F. For temperatures in excess of 1,000°F there is a complete range of CAPOSIL High Temperature Insulations.

CAPE

**CAPOSITE**

The Cape Asbestos Company Limited, 114-116 Park Street, London, W.1. Tel: GROsvenor 6022

*United States Enquiries:* North American Asbestos Corp., Board of Trade Bldg., Chicago 4, Ill.

TA675J

# Our 125 "dry holes"

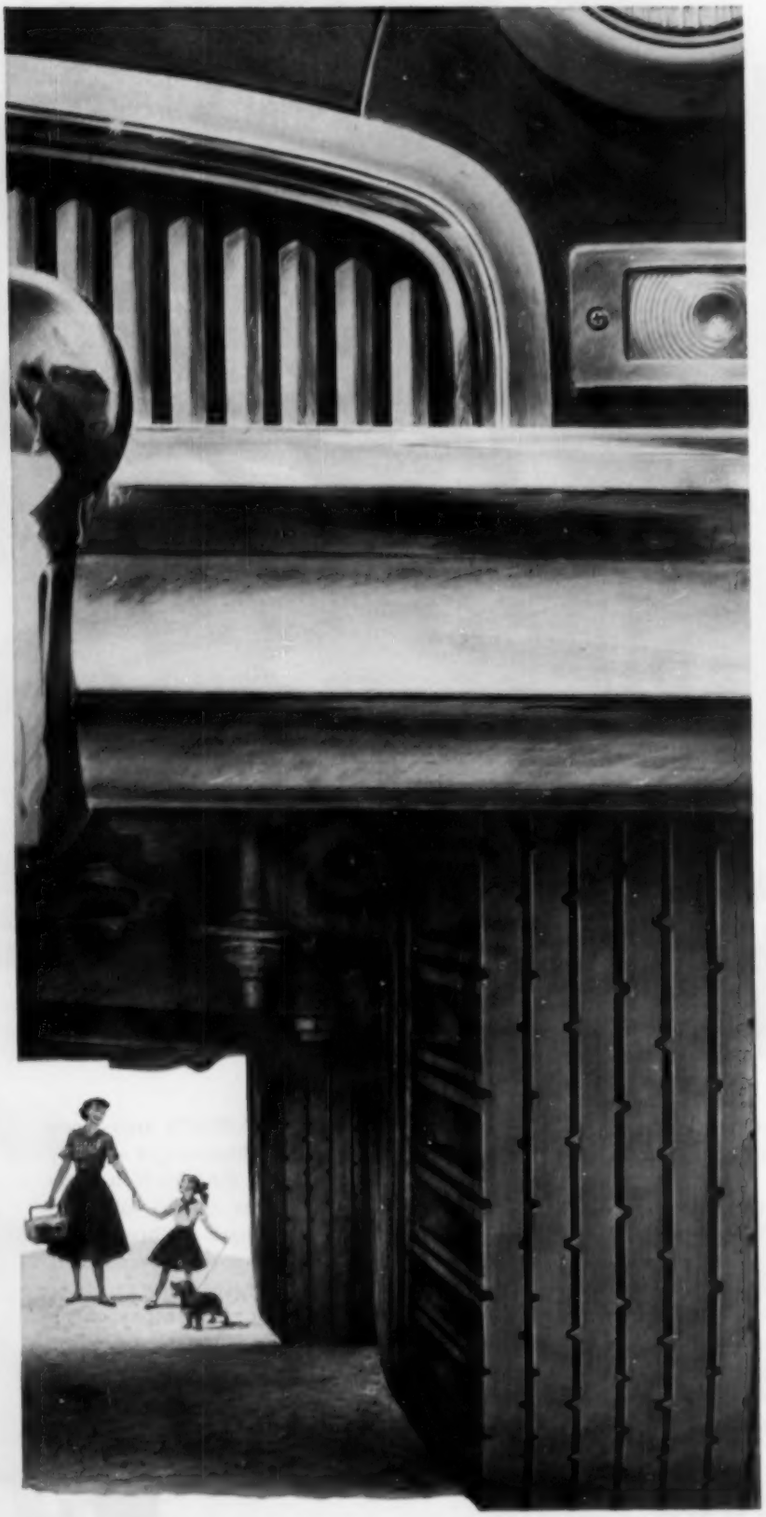
## last year helped keep you on wheels

If you're anything like the average motorist, you'll need about 690 gallons of gasoline to take you where you want to drive this year. And that's just a beginning. Keeping you on wheels and supplying you with the thousand and one "oil-born" products so vital to modern living requires 2 gallons of petroleum a day for every man, woman and child in the U.S. — an increase of 58% since 1941.

Helping to keep this oil flowing to you is Standard Oil Company of California's biggest, most expensive, least predictable job. In fact, we plan to invest $200 million during 1955 alone in exploring for new oil fields and developing existing ones, to help replace the petroleum you'll use.

Some 700 times during the year, Standard drillers will start bits spinning. As much as 16,000 feet of pipe may follow the bit before oil is found or the well is abandoned. Either way it's a costly hole: drilling an oil well may run anywhere from $125,000 to over $1 million. And every one is a risk—only 1 out of every 9 wells drilled in the United States in a promising but unproven area ever turns out to be an oil producer.

Yet new sources of oil must be found to keep our nation's abundant supplies from dwindling. Risking "dry holes" is the only way to find them. So the 125 "dry holes" we drilled last year are good evidence of the job Standard does to help keep you on wheels.



**STANDARD OIL COMPANY OF CALIFORNIA** *plans ahead to serve you better*

# GSI INSTRUMENTATION

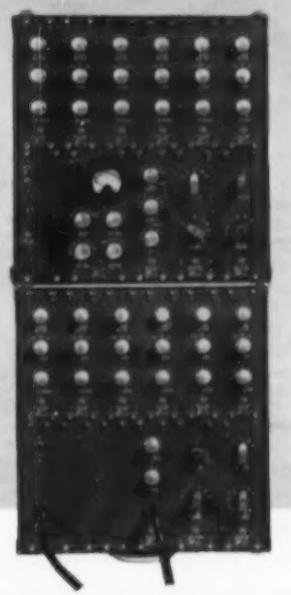
*covers the Seismic Spectrum*

**The VLF (very low frequency) Refraction System**

FREQUENCY RESPONSE 2-50 CPS

**The HR Shallow Reflection System**

FREQUENCY RESPONSE 30-500 CPS



**The 7000 Series Amplifier System**

FREQUENCY RESPONSE 10-200 CPS

# GSI EXPERIENCE

*covers a Quarter-Century*

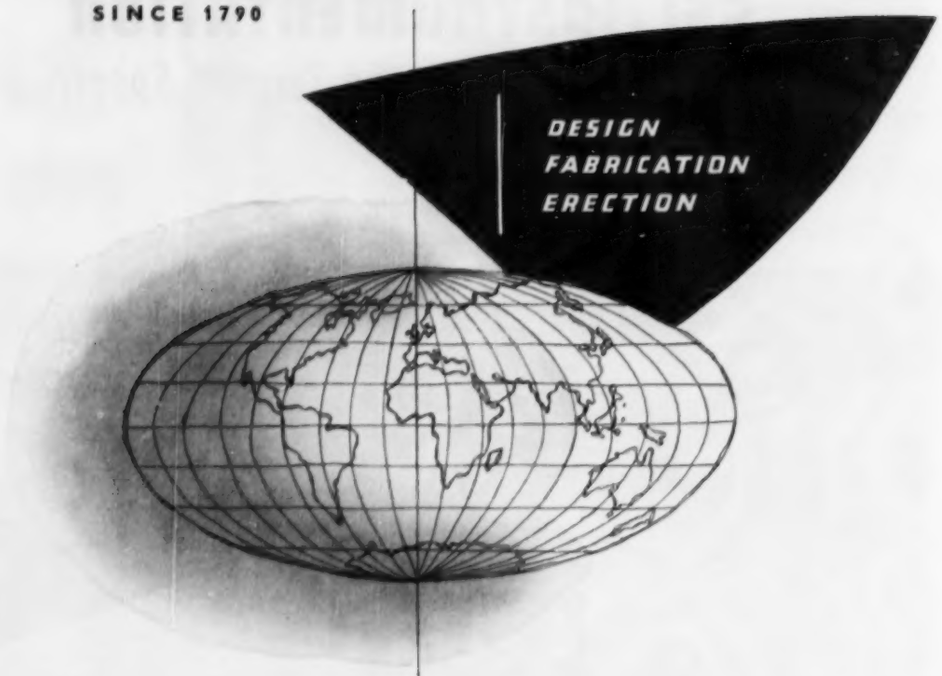
Until recently geophysical work has been limited largely to the 18 to 70 cps frequency range. Now GSI can provide useful data in the range of 2 to 500 cps. Call GSI for service tailored to your seismic needs. ***Write for bulletins on the systems pictured.***

**GEOPHYSICAL SERVICE INC.**

5900 LEMMON AVENUE · DALLAS 9, TEXAS

## *Butterley at home and abroad . . . .*

SINCE 1790



*Constructional Steelwork*

Examples of Butterley structural steelwork are to be found in all parts of this country and in many countries overseas. In recent years, experiments to perfect methods of welded structure have been highly successful.

*Bridge Construction*

Railway and road bridges built by Butterley have been supplied to undertakings in Great Britain and many countries abroad. The Butterley Company was one of the pioneers of the "rolling-in" method now universally adopted. To-day, welded methods are widely used, but many bridges are still of riveted construction.

*Standard Unit Bridges*

Butterley Standard Unit Bridges are in use in many countries providing the ideal solution to speedy bridge construction in places where site preparation is difficult or skilled labour scarce. From five standard units all sizes of bridge can be built.

Also makers of overhead electric travelling cranes, mining and sheet metal machinery, railway wagons and mine cars, Meehanite castings and wrought iron.

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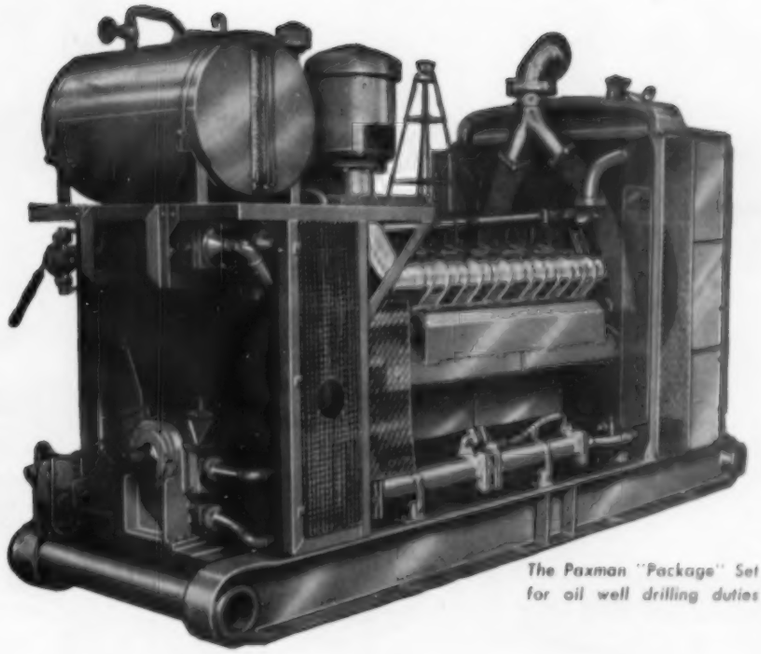


*The Paxman "Package" Set for oil well drilling duties*

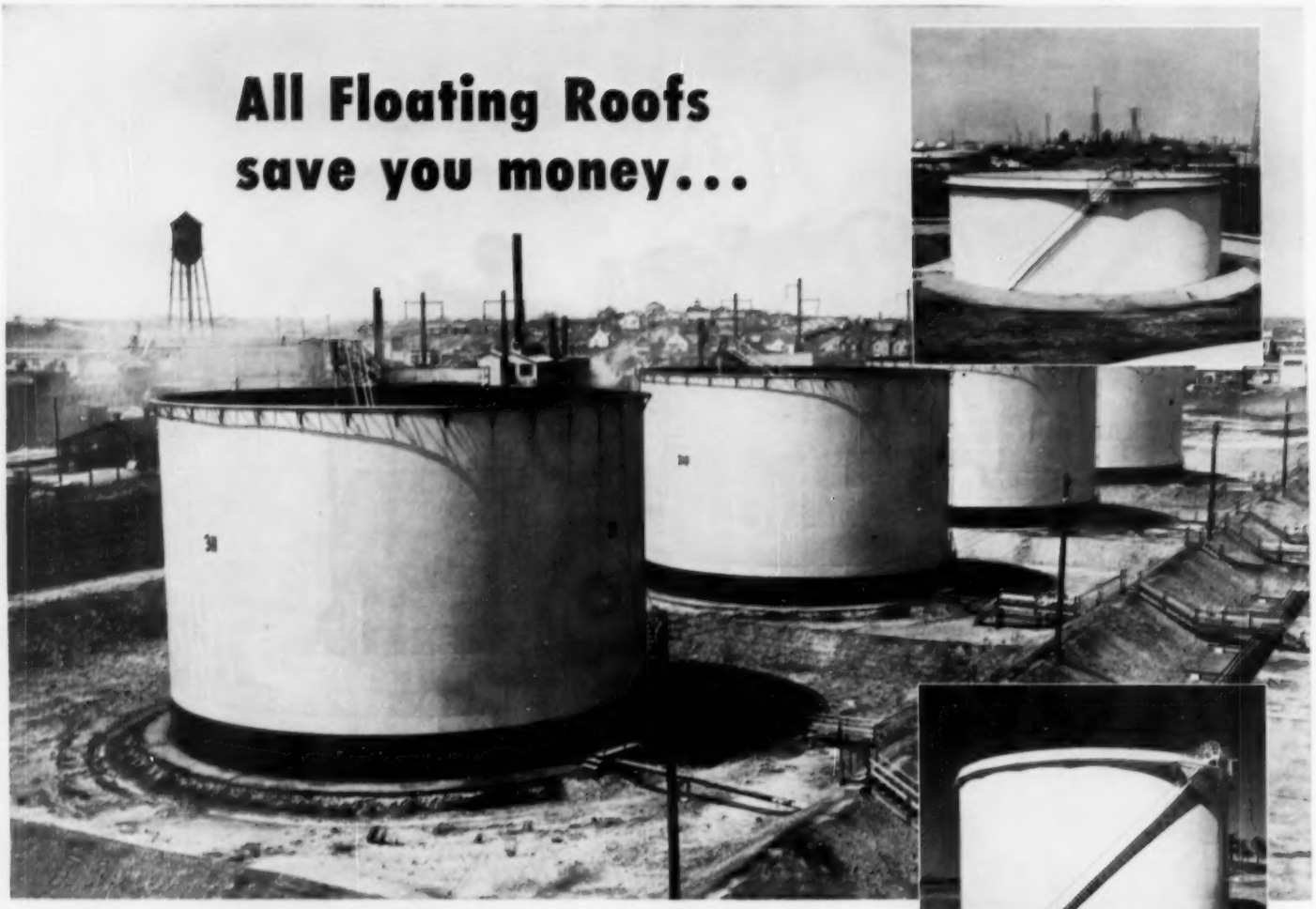
# *packed with power*

**Those engaged in the tough, arduous work of oil well drilling think highly of the Paxman "Package" Set. They like it for its sufferance of rough handling, its ability to keep going under any conditions and its adaptability for almost any type of drilling rig. Paxman Package Sets are available with a horsepower range of 130-665 s.h.p. at the output shaft.**

## PAXMAN *diesel engines for oil well drilling*

**DAVEY, PAXMAN & COMPANY LIMITED COLCHESTER** *(ASSOCIATED WITH RUSTON & HORNSBY LTD. LINCOLN)*

# All Floating Roofs save you money...



***FIND OUT HOW A***

# Wiggins Floating Roof

## CAN SAVE MORE MONEY FOR YOU
## CAN GIVE YOU BETTER OPERATION

Important savings—and all savings that help to improve profits are important—can only come about by doing a specific job better. The performance of the Wiggins Floating Roof has been analyzed and compared with all other types throughout the world in every range of temperature and climate.

It is a proven fact that the Wiggins Triple Seal is a major factor enabling Wiggins Roofs to save more of the volatile vapors—meaning profit—than can any other type. Thus a Wiggins installation "pays out" more quickly.

That's not all; the Wiggins designs take into account those matters of conservation, safety and maintenance so thoroughly that when you have a Wiggins Floating Roof you have one that sets a new, high standard of performance—and in investment, too.

Maybe not today, or tomorrow . . . but *soon* you may decide to modernize by the installation of the finest money-saving equipment available.

However, *now* is the time to write for important technical data comparing Wiggins Floating Roof, feature for feature, result for result, with all other roofs. We can prove that Wiggins Floating Roofs do the best job, the most profitable job, under all conditions.

EXPORT DIVISION
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TRADE MARK

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## GENERAL AMERICAN TRANSPORTATION CORPORATION

**Export Division: 380 Madison Avenue, New York 17, New York**

# TO ADEN

*Photograph by courtesy of Messrs E. B. Badger & Sons Limited and Anglo Iranian Oil Co. Limited.*

This stripping tower constructed to API. ASME, Code is an example of the type of work which Newton Chambers undertake for the oil industry at home and abroad.

*From* THORNCLIFFE

# NEWTON CHAMBERS

## & CO. LTD., THORNCLIFFE, Nr. SHEFFIELD

# off highways or on roads—

International R-140 (4x4) equipped with King winch, rollers, tubular bumper and brush guard (optional).

## INTERNATIONAL 4-Wheel Drive Trucks give maximum traction for bigger payloads!

■ When off-highway going gets tough and traction is the big problem, International 4-wheel drive trucks get through. And for speed on the highway, they perform equally well with the front axle disengaged.

Built for hard work, International 4 x 4 trucks are equipped with dual power take-off openings on the transmission—one side for driving a front-mounted winch, the other side for attaching an underbody hydraulic hoist, or other auxiliary equipment.

Famous Silver Diamond engines provide low-cost, peak performance. Driver comfort, all-around visibility and safety, plus all-truck, heavy-duty engineering makes the 4x4 an unmatched combination of values.

The International 4 x 4 is the only truck of its kind and size in regular production today. Compare the features, drive it—then compare the price! Your International Truck distributor will be glad to show you how you can get unequalled performance, lowest maintenance and operating costs with the right truck for your job. International Harvester Export Co., 180 N. Michigan Ave., Chicago 1, Ill., U.S.A.

### FEATURES

■ Chassis Model R-160 (4x4), GVW rating 15,000 pounds; Model R-140 (4x4) GVW rating 11,000 pounds. Two wheelbases for each model; dual rear tires optional.

■ Engines—International Silver Diamond valve-in-head 220 (R-140) and 240 (R-160); self-cleaning sloroto valves; visible-flow carburetor with fast-idle cam; big capacity generator.

■ Transmission—4 speeds forward, 2 reverse; combined with 2-speed transfer case, 8 speeds forward, 2 reverse.

■ Transfer case—Declutching type; three position shifting; manual engage and disengage of front wheel drive.

INTERNATIONAL TRUCKS

PETROLEUM CHEMICALS DIVISION
# NEWS

April ★ One of a Series of Interest to the Petroleum Industry ★ 1955

## THE "SIGN" OF A GOOD CUSTOMER

***This booklet can help your dealers to recognize it . . . and profit from it***

Credit customers, as you know, are generally *good* service station customers. They buy, for example, an average of *three gallons more* gasoline than cash customers and spend almost a *dollar more* per sale.

But many service station dealers and attendants fail to realize the value to them of these important customers. So to help your dealers get a better picture of the credit sales potential, we suggest that you distribute the above booklet to them. Entitled "A look at the credit customer," it is No. 3 in Du Pont's new "Looking through the windshield" series.

Any Du Pont Petroleum Chemicals Division representative or regional office will give you sample copies of these booklets . . . and cost information on ordering them in large quantities.

## OCTANE NUMBERS— *Where are they going?...*

**Here's how the Du Pont Quarterly Motor Gasoline Quality Survey can be of real value to you for long-range planning.**

The average research octane numbers of all gasoline produced by the American petroleum industry have been steadily rising since the end of World War II. This average has risen from 84.3 in 1949 to 88.3 in 1954. The above figures are based on averages for both "regular" and "premium"—weighted on an area-grade-volume basis.

Of particular interest is the fact that the rate of increase during 1954 was nearly twice the rate of increase during 1952 and 1953.

And, based on the many new catalytic reforming facilities expected to come into operation during 1955, no slackening in this rapid rate of increase in octane numbers is expected to take place during this year.

The above information gives you an over-all picture of the national trend. But how do you relate it to your own individual situation? . . .

Right in your copies of the Quarterly Du Pont Motor Gasoline Quality Survey are all the details you need for applying the national trends to your own local marketing situation. With a number of previous issues in front of you, you will notice that almost every city or area tends to keep its own relative position in the over-all trend.

It is in analyzing and forecasting these long-range trends on a marketing area basis that your Du Pont Quarterly Survey can be most valuable to you. And each year, as new reports are added to the survey, it becomes more valuable as a planning aid.

# New Movie to Help Your Dealers Cope with KNOCK Complaints

"When the customer says 'KNOCK' " is the title of a new movie that offers your dealers a quick visual education on how to answer knock complaints in a salesmanlike way.

It is a 15-minute live-action sound movie in full color. Introduced by Tom McCahill, noted automotive writer and car authority, the film was produced by the Du Pont Petroleum Chemicals Division for oil company use.

**DRAMATIC PROOF** of the mechanical, natural and human causes of knock are clearly demonstrated in the movie by the chassis dynamometer.

The film explains dramatically the seven most common causes of knock—none of which are caused by gasoline quality. It gives dealers a clear, concise picture of how such things as temperature and altitude, poor mechanical adjustments, and bad driving habits cause knock. To help demonstrate these points the two-story chassis dynamometer at the Du Pont Petroleum Laboratory is shown in action in the film.

### Familiar situations

To dramatize the causes of knock and make them readily understandable to dealers and customers, typical motorists driving several different popular makes of cars are shown encountering engine knocking problems under familiar, everyday

OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

DU PONT

PETROLEUM CHEMICALS DIVISION
# NEWS

DU PONT

CONTINUED "Knock" Movie

driving conditions. This part of the movie also dramatizes the reactions of many customers whenever they hear an engine knock . . . a reaction which frequently, and erroneously, causes them to blame the gasoline rather than the true cause of the knock.

The problem of Ed Gilbert, a character in the film, is typical. Ed is shown driving his '54 Ford sedan down to the plains from a high mountain area where his home is and where much of his driving is done. As soon as he starts pushing his car across the low-level plains country, the engine begins to knock.

And what does Ed do about that knock?

He immediately decides the gasoline brand he's been using is no "blankity blank" good. And he, therefore, decides to switch his brand immediately.

**Who's the real villain?**

But will the switch really solve Ed's problem? Of course not. The villain causing the knock is the change in altitude. And the solution to this problem is a proper adjustment in the carburetor setting.

Other common causes of knock are graphically and dramatically explained in the movie. Examples of knock caused by changes in humidity and temperature . . . by mechanical factors such as an over-advanced spark, or a faulty water pump, thermostat or fan belt . . . and by poor driving habits are all included.

**Good public relations**

The more your dealers know about the common causes of knock, and the more of this knowledge they are able to pass along to their customers, the less you and your products are likely to be blamed for engine knocks.

The new Du Pont movie, "When the customer says 'Knock'," can help you tremendously in this important work. What's more, with its live-action drama and easy-to-understand dynamometer demonstrations, it is also suitable for showings to customer groups.

**Available to you**

A limited number of prints of this new movie are now available for your use. More are being made. Before you order yours, we suggest you contact our local representative for an advance showing.

## ASSISTANT GULF COAST REGIONAL MANAGER

BARRY V. CORNWALL is now assistant manager for the Du Pont Petroleum Chemicals Division's Gulf Coast Region with headquarters in Houston, Texas. He was recently transferred to this post from the Division's Eastern Region, where he also served as assistant regional manager.

Since 1929, Mr. Cornwall has been continuously associated with the Du Pont Company. Following his first assignment as a technician in the service laboratory of the Dyestuffs Division, he became a salesman for the Alcohol Division's anti-freeze and industrial solvents. He later became assistant sales manager of the Alcohol and Camphor Section. He then joined the Petroleum Chemicals Division in 1952 as technical assistant to the director of sales.

Mr. Cornwall was born in Winnepeg, Canada, and graduated from Clemson College in South Carolina. During World War II, he served four years in the U. S. Army.

## Write for this new book on Du Pont Lube Oil Additives

Polymeric lube oil additives combining effective low-duty detergency and V. I. improver qualities are a new and revolutionary development. And, until now, adequate information on their properties, application, and methods of addition has not been readily available.

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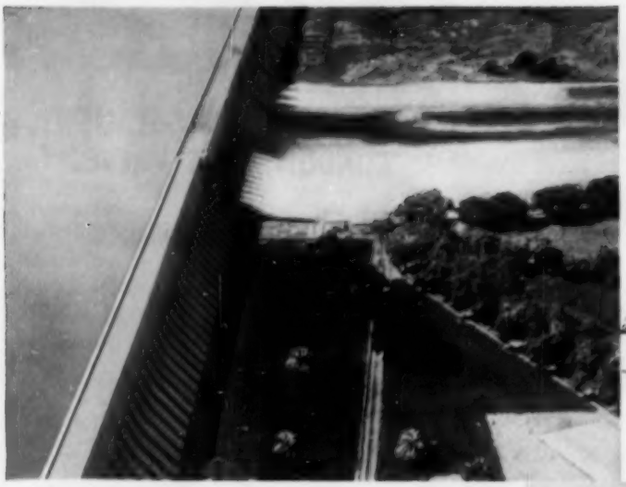

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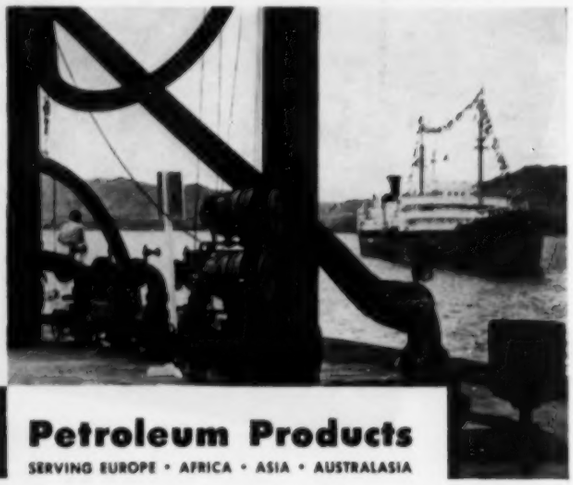

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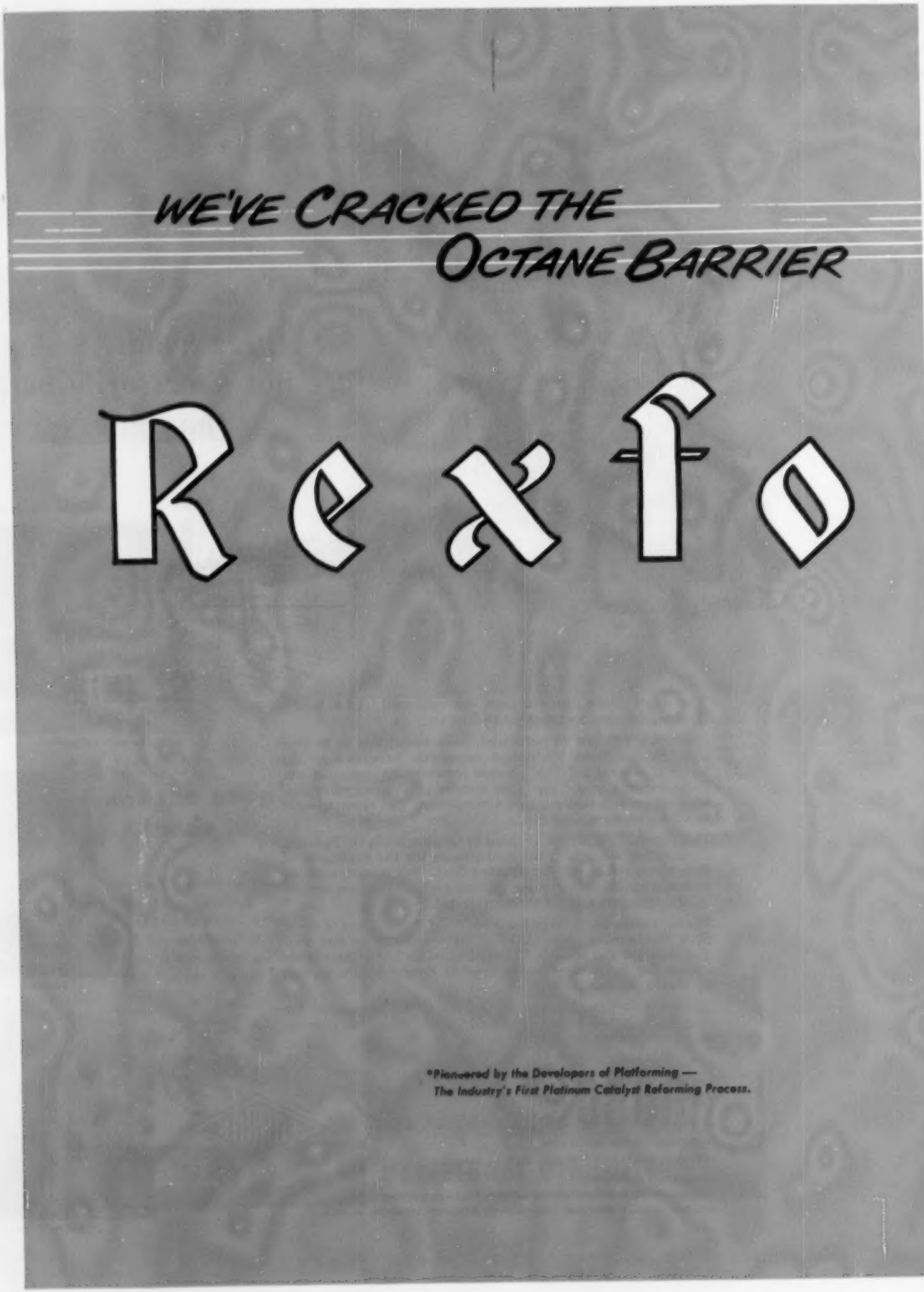
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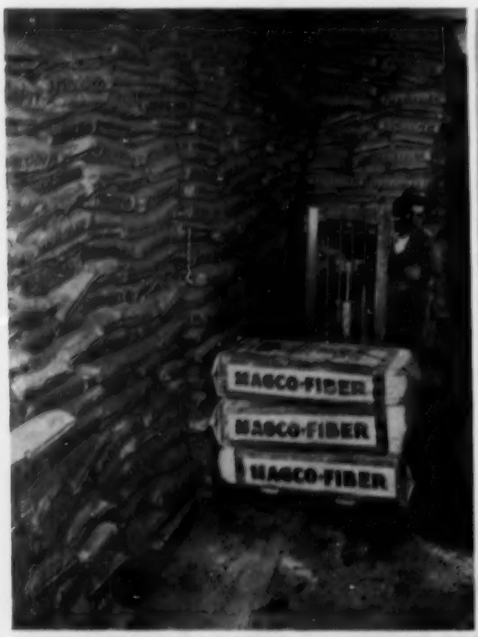


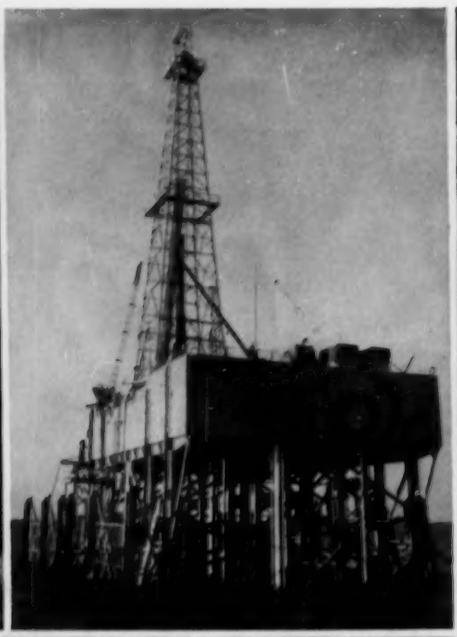

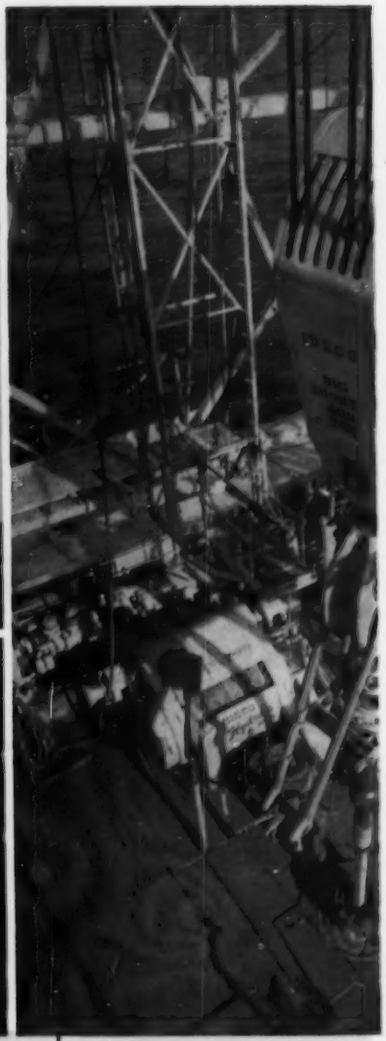

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November 3, 1954

Mr. C. A. Barrere
Vice President
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2707 Weslayan Road
Houston, Texas

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It is with a great deal of satisfaction we advise you and The Lummus Company of your outstanding performance and the remarkable record you achieved in the construction of our refinery here at Corpus Christi. The contract with your company was signed on February 6, 1952; groundbreaking ceremonies were held March 12, 1952, and you completed the refinery in eighteen months under the most adverse conditions and scarcity of materials. The expediting of the materials and the know-how of engineering and construction methods are the two prime factors in this record breaking completion.

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We are very happy with all phases of the plant. As a matter of fact, it has operated at a greater capacity than originally planned. I am pleased to advise that in all of my refining experience, I have never witnessed a more satisfactory installation, and all of us here at Suntide are very proud of our refinery's performance as well as its appearance.

We would appreciate your extending our sincere compliments for a job well done to all members of your organization who had part in the building of Suntide.

Yours very truly,

FLM/b:

VOL. 26, NO. 4, APRIL, 1955

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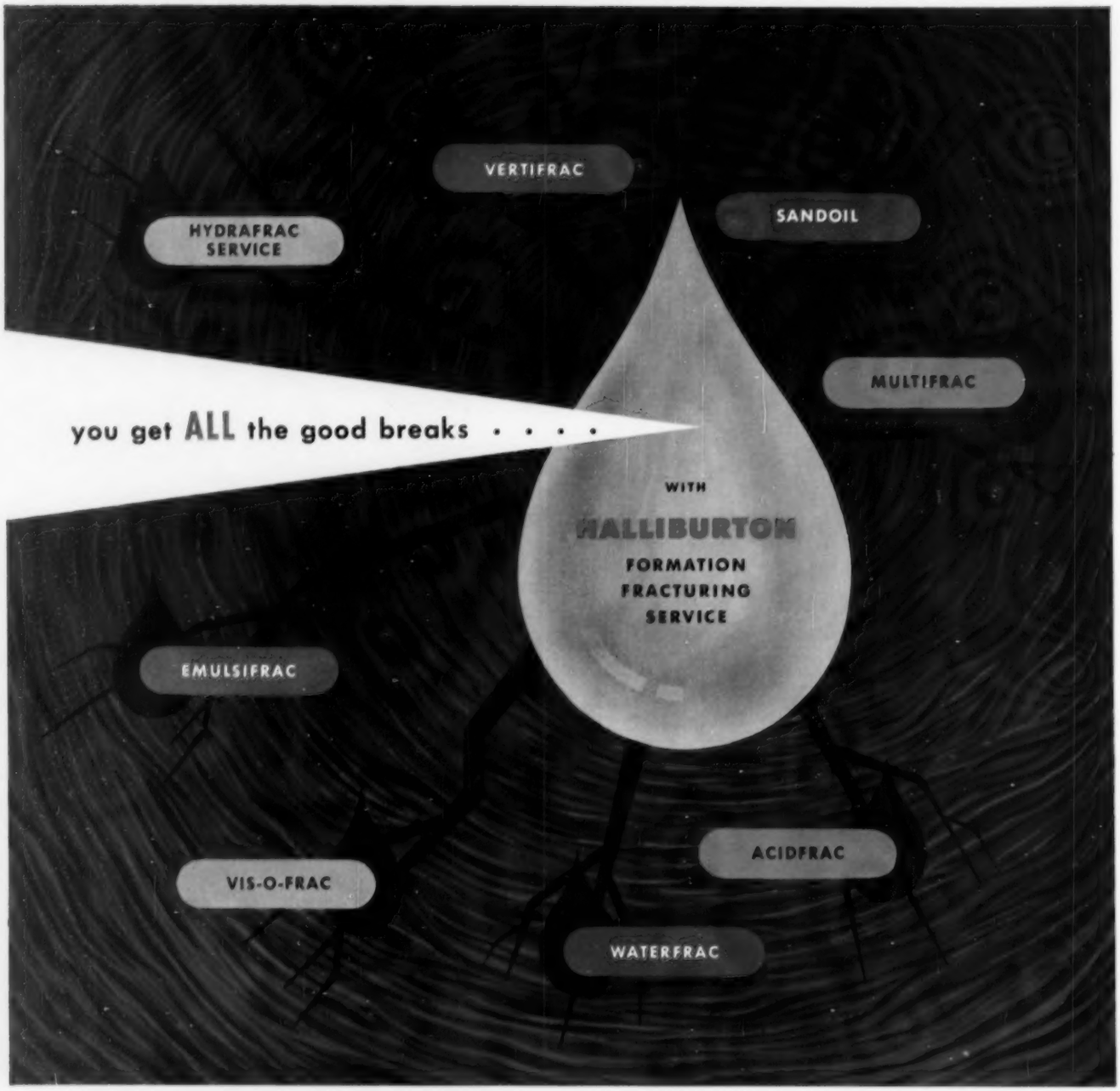
THIS MONTH'S COVER

Creole Petroleum Corporation has just dedicated its $20 million Tia Juana repressuring plant built seven miles from the shore in Lake Maracaibo, Venezuela. Color plates picturing the new plant are reproduced on the cover through the courtesy of the editors of *El Farol*, Creole house magazine. Right, view of the ten gas turbines which together supply 60,000 horsepower in the new plant.

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# Energy resources report raises national issue

WHATEVER MAY BE the ultimate fate of the report submitted to the President at the end of February by the Cabinet Committee on Energy Supplies and Resources, or whatever effect it may have on national policy, it has served to arouse widespread interest and discussion not only in the United States but in other countries.

This is true for two reasons. In the first place the report deals with issues that are being hotly fought over both in and out of Congress and that are the subject of divergent proposals being pressed for action by the national legislature. In the second place, it brings into clear focus an underlying principle that has been regarded as basic to the nation's progress during most of its history.

By the President's directive, the committee was instructed not only to evaluate the energy resources of the country from the viewpoint of national defense, but also to "review factors affecting the requirements and supplies of the major sources of energy" which are specifically named as petroleum, natural gas and coal.

Historically the division of power in the American Union has left production and the regulation of local affairs in the hands of the states or their subdivisions, while action by federal authority in relation to private industry has originated in efforts to discourage unfair competition, to eliminate abuses or to prevent monopoly.

In its recommendation regarding natural gas, the committee follows this historic line of division. It declares forthrightly: "We believe the federal government should not control the production, gathering, processing or sale of natural gas prior to its entry into an interstate transmission line." Interstate transmission and subsequent sale, it adds, is a public utility function and should be under regulation by the Federal Power Commission, while states or their subdivisions should continue the regulation of distributing companies. Thus, says the committee, "the complete cycle of natural gas production, transmission and utilization will be appropriately regulated."

On the hotly-debated question of oil imports, the committee proposes a compromise which has been discussed within the industry, but has not been considered as an official solution. Their recommendation is that imports of crude and residuals be held in the same ratio to domestic crude as they occupied in 1954. The novel feature about this proposal is the recommendation that it should be carried out by voluntary action on the part of importers.

In advancing this solution, the report obviously recognizes the strong feeling against legislation that would drastically cut the volume of imports to the dislocation of established trade relations, and against placing regulatory power in a federal bureau which might be the first step toward complete governmental control of the industry. This antipathy toward bureaucratic control has been influential in keeping many producers who favor some limitation of imports from giving their support to the inflexible methods that have been proposed. The committee expresses the belief that its recommendation will be accepted as a means of avoiding government intervention, but adds the qualification that if imports greatly exceed the proportions established "appropriate action should be taken." Evidently the hope of the committee is that early acceptance of its plan by the principal importers of crude and products will provide assurance of its feasibility. Some of the largest importers already have announced that they will hold their imports below the level proposed by the committee, but this obviously requires unanimity to be effective and individual action to be legal.

The chief value of the report lies in bringing out clearly the issue between those who believe that the national welfare is best served by preserving freedom of initiative to the individual and holding necessary controls so far as possible to local levels and those who favor the continuous extension of government control and management over industry. The latter have been prompt in attacking the committee proposals on the ground that they will pave the way to an increase in the cost of gas to consumers, a claim that is as strongly denied by gas producers. The choice should be a step toward determining the type of government preferred by the American people.

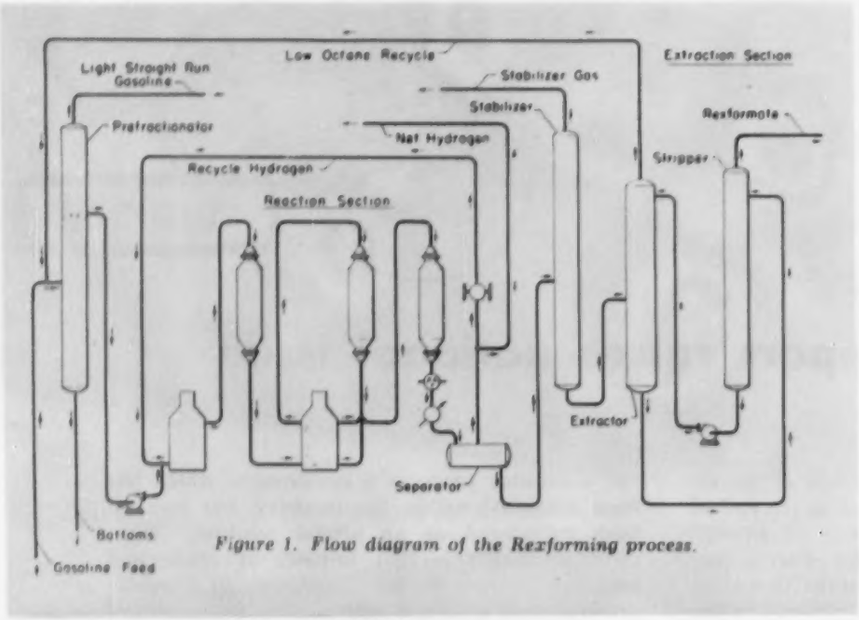



*Figure 1. Flow diagram of the Rexforming process.*

# TWO NEW REFORMING PROCESSES

## *offered to oil refiners*

TWO NEW PROCESSES for upgrading refinery gasoline to 100 octane levels have been announced to the petroleum industry within the past few weeks. Universal Oil Products Co. of Chicago has announced a new process to be known as Rexforming, and Houdry Process Corp., Philadelphia, has announced the Iso-Plus process with similar claims. Both processes combine previously developed catalytic reforming operations with suitable methods of removing aromatics and recycling low octane fractions for further reforming.

Object of the processes is to increase the octane level of the recycle stock by catalytic aromatization, hydrocracking and other reactions which normally occur in catalytic processing.

Rexforming, a new process for upgrading full boiling gasoline, was described to the Western Petroleum Refiners Association annual meeting at San Antonio March 29 by H. W. Grote, V. Haensel and M. J. Sterba of Universal Oil Products Co. Reformate in the 100 octane range is said to be produced. The new process is, in effect, a modification of Platforming to which a solvent extraction section has been added for the removal and recycling of low octane paraffins. Certain of the paraffins may be removed for sale as jet fuel or as solvents.

Employment of the solvent extraction technique plus the recycling of low octane paraffins permits the use of mild process conditions. Side reactions are said to be minimized and catalyst life expanded. Low naphthene content stocks may be processed.

Existing Platformers may be revamped to employ the Rexforming process. No additional catalyst is required for a plant with the same fresh feed. Some additional heat exchange equipment and the solvent extraction section must be added.

The authors reported that a Rexformer will cost about $300 per barrel to build and about 36 cents per barrel to operate, excluding royalty, depreciation, administration and overhead.

A diagramatic flow chart of the Rexforming process is shown in Figure 1. Describing the flow to the WPRA, the authors said that "a full boiling range gasoline is fed to a reboiled prefractionator which removes overhead a light gasoline fraction. The side-cut from this column is the combined feed to the reaction section. The flow through the reactors which contain the Platforming catalyst and through the heaters is similar to that of a Platforming unit. The reactor effluent, after cooling, passes to a separator, from which a hydrogen rich gas is circulated to the reactors. The net vent hydrogen is also removed from this separator.

"The separator liquid is fed to a stabilizer which in this case serves as a debutanizer. The stabilized material is charged to an extraction column, which

continuously rejects from the top of the column the low octane number components. This rejected stream is returned to mix with fresh feed, achieving selective conversion of low octane heavy paraffins to high octane components. The separation in the extractor is selective in that the higher boiling non-aromatics, and these are the lowest octane constituents of a reformate, are least soluble in the solvent. On the other hand, the aromatics and the lower boiling non-aromatics, both of which are the high octane components, are relatively more soluble and are removed from the extractor with the rich solvent.

"Dissolved hydrocarbons are removed from the rich solvent by stripping, yielding a gasoline of well balanced boiling range as the high octane product of the process. Lean solvent from the stripper is returned to the extractor to complete the solvent cycle.

"In the Rexforming process, the reaction section can be operated at mild conditions to produce an effluent having an octane number of 75 to 85 F-1 clear and containing 35-45 percent aromatics. The extraction section serves to separate from this effluent a stream of increased aromatic content, containing the highest octane paraffins in the reactor effluent. This stream, the Rexformate, when of 100 clear octane number, will contain 60-65 percent aromatics. The remaining low octane, higher boiling paraffins are left in the raffinate stream, to be recycled to the reforming section for further processing. Further, minor amounts of aromatics can be left in the recycle raffinate stream without effect on the efficiency of the process. Thus, investment and operating costs for the extraction section are much lower than those for extraction operations designed to make pure aromatics at high recoveries."

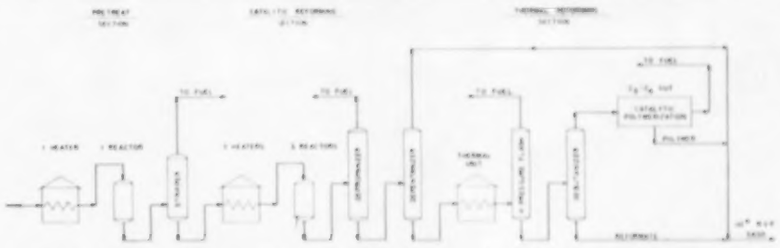


*Figure 2. Flow diagram of new Iso-Plus process developed by Houdry Process Corp. In this particular instance, the paraffin concentrate is thermally reformed. Other versions provide for recycling through the catalytic section or processing in a separate catalytic reformer section.*

Object of UOP research leading up to Rexforming was to increase the conversion of all charge stock components to higher octane levels and to enlarge the range of suitable charging stocks. An investigation of the characteristics of non-aromatics in Platformates of 95 to 100 clear F-1 octane rating showed that the contained non-aromatics range from 20 to 40 clear octane, with the lower values being associated with the higher boiling feed naphtha. At higher severities, the non-aromatic portion increases in octane number due to selective removal of heavier paraffins both by dehydrocyclization to aromatics and by hydro-cracking to lower boiling, less reactive and higher quality paraffins. A detailed examination of the non-aromatic portion of a different Platformate is given in Table I. The lowest octane ratings characterize highest boiling fractions.

While reformers can be operated on a once-through basis to produce 100-octane reformate, the severity of conditions causes excessive loss to gas and coke and other undesirable results. By selective removal of high octane fractions and recycling of low-octane paraffins the UOP researchers were able to attain desired results under mild conditions.

The low octane stream may be handled in a separate catalytic reforming section. However, experiments in completely integrated laboratory and pilot plant units proved that recycle of this material to the catalyst in a mixture with raw feed is completely practical. Such operations are characterized by low recycle ratios and high liquid recoveries of very high octane gasolines, UOP reported.

The results, shown in Table II, were obtained in Rexforming a Midcontinent naphtha in a laboratory unit. Both tests were run at the same temperature level. This temperature was more than 50°F lower than would be required for once-

*(Continued on page 56)*

**TABLE I**

**NON-AROMATICS FROM A PLATFORMATE**

| Fraction No. | Fraction Boiling Range °F | Fraction Volume % of Total | F-1 Clear Octane No. |
|---|---|---|---|
| 1 | Up to 115 | 14.4 | ... |
| 2 | 115-142 | 9.9 | 80.5 |
| 3 | 142-151 | 10.0 | 68.7 |
| 4 | 151-157 | 10.0 | 47.4 |
| 5 | 157-194 | 9.9 | 63.3 |
| 6 | 194-199 | 10.2 | 55.6 |
| 7 | 199-219 | 8.8 | 18.6 |
| 8 | 219-261 | 13.0 | 35.4 |
| 9 | 261-306 | 8.5 | 9.3 |
| 10 | 306-349 | 3.9 | 3.8 |
| 11 | Bottoms | 1.4 | Not determined |
| | | 100.0 | |

**TABLE II**

**LABORATORY REXFORMING DATA MIDCONTINENT FEED STOCK**

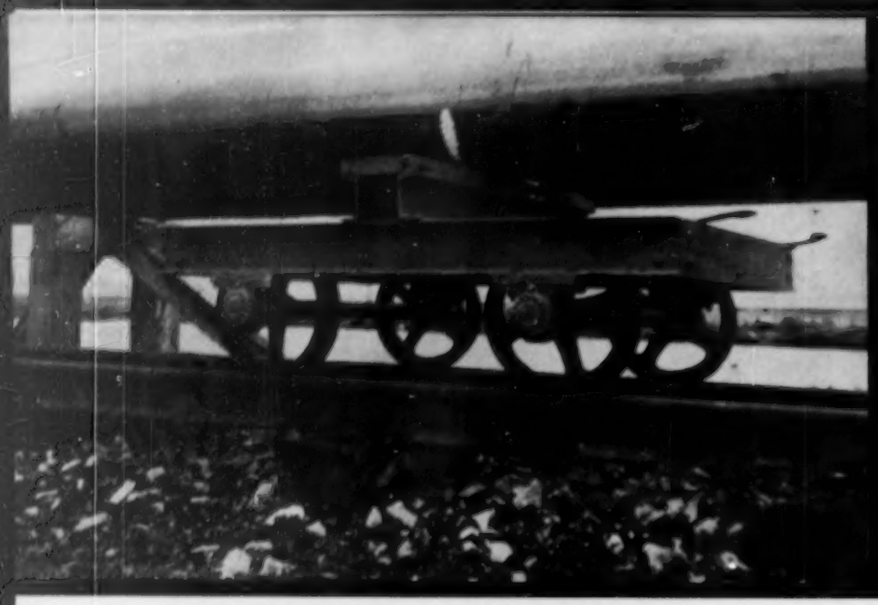
| Test No. | Charge | 1 | 3 |
|---|---|---|---|
| Inspections of Rexformate* | | | |
| Gravity, °A.P.I. | 52.5 | 44.3 | 37.3 |
| F-1 Clear Octane | 30.0 | 95.2 | 101.8** |
| Aromatics, Vol. % | 8 | 56 | 77 |
| 100 Ml. Distillation | | | |
| I.B.P., °F. | 248 | 124 | 120 |
| 5% | 264 | 162 | 160 |
| 10 | 270 | 180 | 189 |
| 30 | 289 | 249 | 288 |
| 50 | 312 | 297 | 326 |
| 70 | 340 | 339 | 353 |
| 90 | 370 | 382 | 392 |
| 95 | 379 | 402 | 413 |
| E.P., °F. | 390 | 426 | 429 |
| Yields | | | |
| Separator Gas, SCF/Bbl. | | 856 | 1090 |
| Debutanizer Gas, SCF/Bbl. | | 246 | 296 |
| Debutanized Rexformate, Vol. % | | 82.9 | 76.8 |
| 10# R.V.P. Rexformate, Vol. % | | 92.3 | 85.0 |

*Debutanized. **C.R.C. Octane scale extension.

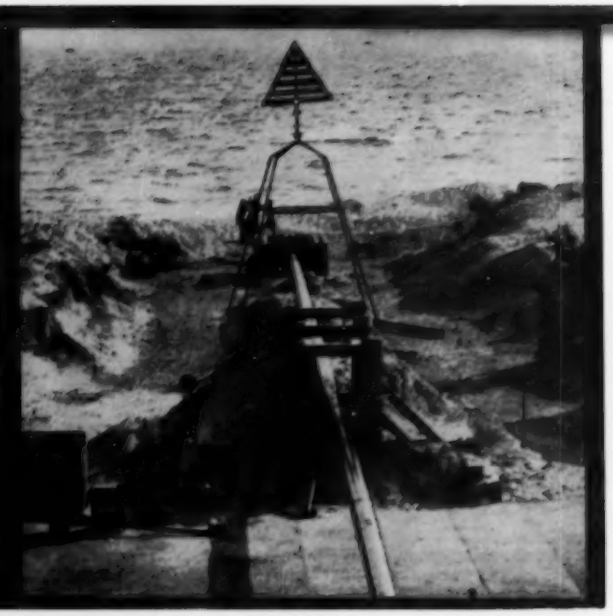
**TABLE III**

**LABORATORY REXFORMING DATA LOW NAPHTHENE FEED**

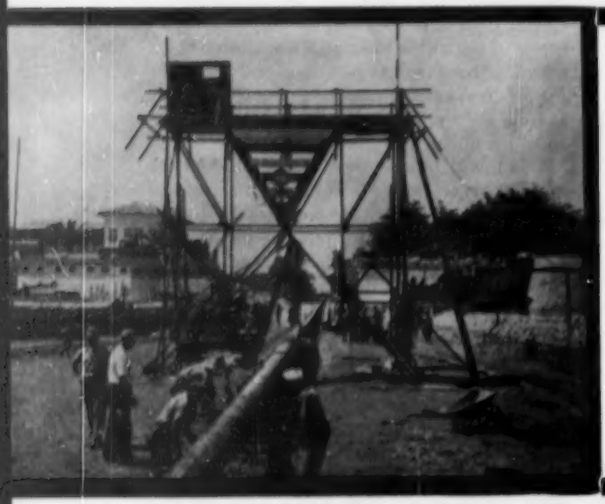
| Inspections | Charge | Rexformate |
|---|---|---|
| Gravity, °A.P.I. | 59.6 | 47.1 |
| F-1 Clear Octane | 10.3 | 101.0 |
| Naphthenes, Vol. % | 12 | .... |
| Aromatics, Vol. % | 3 | 59.2 |
| 100 Ml. Distillation I.B.P., °F. | 254 | 110 |
| 5% | 265 | 153 |
| 10 | 268 | 167 |
| 30 | 282 | 239 |
| 50 | 296 | 278 |
| 70 | 320 | 306 |
| 90 | 351 | 345 |
| 95 | 365 | 364 |
| E.P., °F. | 390 | 415 |
| Yields | | |
| Separator Gas, SCF/Bbl. | .... | 940 |
| Debutanizer Gas, SCF/Bbl. | .... | 484 |
| Debutanized Rexformate, Vol. % | .... | 68.2 |
| #10 R.V.P. Rexformate, Vol. % | .... | 74.3 |



*A railroad track is laid and the pipes of the first section to be pulled are placed on dollies and welded together. The pipes of the following section are placed on trestles as near the track as convenient and welded together.*



*At the sea end of the track a "dolly pit" is built of steel plates tack-welded together to form a platform. A "throat" is constructed at the seaward side of the dolly pit to act as a guide for the sea line. The first section of pipe is moved forward and a "sea sled" is clamped to the pipe ten feet from its end.*



*A temporary "signal bridge" is erected on the landward side of the dolly pit for the operator in charge. A "target" to assist in keeping the towing vessel in line is fastened to the front of the bridge.*

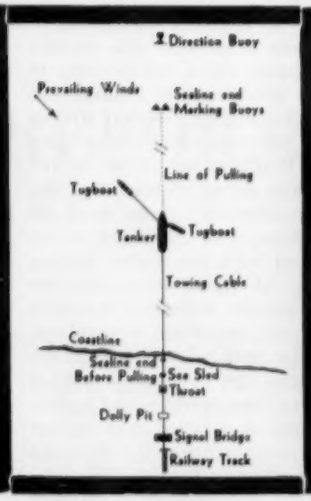



*Diagram showing position of all the elements in the pulling operation.*

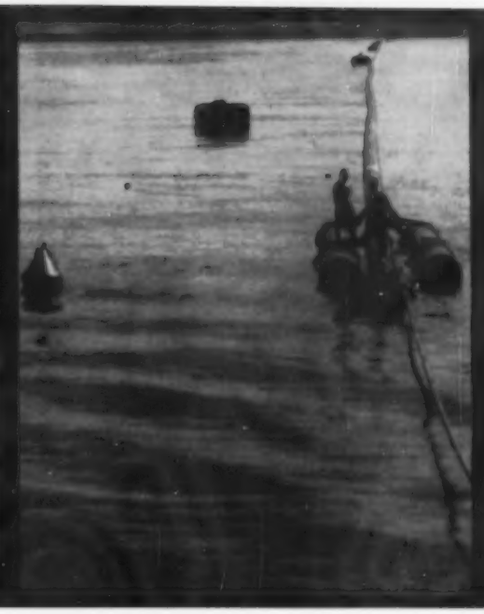
*Towing cable is shackled to the swivel in the towing bridle. The vessel's engine is given the "slow ahead" and, as the sea sled pushes the sand in front, the pipe moves on its slow trek into the sea.*

*Sea line end marking buoy is floating behind the sea sled as it is about to submerge.*

*The second section of sea line is moved over onto the dollies.*

*With bow anchors out, wires to bow buoys and stern buoys, a tanker is loading in strong wind and rough sea.*

*In a floating operation, the white flag is hoisted, and one and a half miles of pipe moves from the pulling strip, the end buoyed by a pipe pontoon.*



*Several large buoys are anchored in line where the sea line will be sunk, a small buoy marking its end location.*

*The valve has been opened and the pipe is gradually sinking while seamen recover ropes, releasing pontoon from the sea line.*

# SUBMARINE OIL LOADING LINES

**By Ivar W. Buch***

SEA LOADING TERMINALS became an economical venture when crude oil was discovered in various parts of the world where the nearest seashore point was a considerable distance away from suitable harbors. Where a natural harbor can be found, the cost of constructing piers and jetties is not too great, but when breakwaters have to be built to protect these structures and the tankers loading there, the cost becomes uneconomical.

Sea loading terminals have an advantage over harbor and dock terminals in that they are an integral part of the oil company's installation with a minimum of interference from outside sources. Another advantage is that practically no damage is ever done to a tanker loading at sea berths while vessels loading inshore may collide with pierheads or other structures. Incidentally, the fire hazard is higher when loading takes place at a dock.

Before the site for a sea loading terminal can be considered, it must be ascertained that it meets certain requirements, including a sufficient depth of water for the largest tankers to maneuver at a safe distance from shore. The sea bed from the shore line to the proposed berths should have a uniform grade. The shore site must have available space for the building of oil tanks, pump stations, stores, workshops and buildings required for offices and residences. A considerable amount of survey work is done between the drilling center in the fields and the proposed terminal in order to determine the most advantageous route over which to lay the main line that is to deliver the oil to the terminal. When these objects are achieved it is necessary to obtain the local government's permission to build before any work may begin. Also, the right of way for pipe line and areas required for the whole project must be leased or bought from the land owners.

There are two methods used in laying sea lines. The older one, still used with pipes of 8-inch to 16-inch diameter and where there is a strong current or rough sea, is to pull the line out on the sea bed with a vessel's heavy towing cable. The other and newer method, used mostly with pipe of 18 inches and over, is to float the line out to a position prepared with buoys to hold it in place and then fill it with water permitting it to sink to the sea bed.

Before a loading site can be established, the sea bed must be sounded for depth of water over the whole area where the sea lines are to be laid and also on the seaward side of the berths to insure a safe approach for the largest tankers. This work is best done by the use of a large motor launch equipped with echo sounding apparatus which will record on a chart roll in a continuous line the depths of water over which the "oscillator" passes. These depths are then transferred to a map of the area and contour

* *Marine superintendent, Iraq Petroleum Co. Ltd.*

lines are drawn giving a complete picture of the sea bed. From this map a "pulling strip" for the sea line is laid out and a diver walks the sea bed in a zig-zag line between shore and the proposed berth where tankers will moor. This is necessary in order to locate any obstruction on the sea bed which may have to be removed or may influence the position of the pulling strip. When the location for the seaward pulling strip has been decided, the survey is continued on the landward side in the same direction. On land the grading of the pulling strip must be practically uniform, for here a railroad track is laid for the dollies to carry the sea line. A considerable amount of cutting through high level ground may be required, back filling where the ground is low, and diversions of roads or even streams may be necessary to obtain a good pulling strip.

When the grading is completed, a railroad track is laid, aligned and ballasted. The track should be 30 to 36-inch gauge, depending on the diameter and weight of the pipe. The sea end of the track is placed about 150 feet from the high water mark. The length of the track should be the same length as the sea lines, if possible. Usually, however, where lines have a length of up to 10,000 feet, it is impracticable to construct a pulling strip of this length. The pipe must then be pulled in two or even three sections. This is done by laying the pipes of the first section to be pulled on dollies which are set about 35 feet apart on the track and the pipes are then welded together. The pipes of the following section are placed on trestles as near to the track as convenient and welded together. A third section of pipe, if required, is placed near the second section. The first section of pipe is pulled out to sea and stopped when the shore end is opposite the sea end of the second section. The dollies, having been brought back to the main track from the dolly pit, are again placed 35 feet apart and the second section of line is rolled over and placed on the dollies which are then moved forward and the pipe is welded to the first section.

Usually the pipe is "doped" before it is hauled into the sea by applying a coat of tar enamel, after which it is wrapped with fibre-glass and a second coat of dope is applied. However, cathodic protection for retarding corrosion of the steel pipe on the sea bed is resorted to more and more and sea lines are being pulled without being painted or enamelled.

At the sea end of the track, a "dolly-pit" is built of steel plates tack-welded together to form a platform about 25 by 60 feet. The floor of the dolly pit is nine inches below the top of the track so that the dollies leaving the track, as the pipe is moving out, drop clear of the pipe and men standing by haul alternate dollies to either side. From the dolly pit, tracks are laid on each side of the main track so that the dollies may immediately be cleared away from the pit and at the same time returned in readiness for the second section. A "throat" is constructed on the seaward side of the dolly pit to act as a guide for the sea line and keep it aligned with the track as it is pulled into the sea. On the landward side of the dolly pit a temporary signal bridge is erected 20 feet over the track with mast for signal flags. Here the person in charge of operations will have a complete view of the actual pulling of the line. Communication between the signal bridge and the vessel towing the line is by VHF radio sets which are also installed in tugboats and launches.

To assist in keeping the towing vessel in line with the railroad track, two diamond-shaped targets 14 feet high and eight feet wide are placed directly over the track and 20 feet above it, the front target being fastened in front of the signal bridge and the back target erected some 2,000 feet inland.

The track having been laid, the first section of pipe welded together, dolly pit and throat constructed and signal station erected, the first section of the pipe is then moved forward, its seaward end crossing the dolly pit and passing through the aperture in the throat. The pipe is stopped when the end is about 75 feet from the high water mark. A "sea sled," 14 feet long, eight feet wide and three feet high, is constructed in the shape of a barge. The sea line passes through holes in the ends of the sled, which is then clamped to the pipe 10 feet from the sea end. The sled will insure that the pipe will not bury itself on the sandy bottom as it is pulled along the sea bed and it will also raise the pipe over small obstructions. The "towing bridle" of 5-inch circumference steel wire cable is fastened to the pipe with steel clamps and a heavy swivel is shackled to the bridle. To the end of the sea line is also fastened a marker buoy with a wire a few feet longer than the depth of water at the sea line end location. This buoy will indicate the location of the sea line end as it proceeds over the sea bed.

A vessel for towing the sea line, usually a tanker of from 12,000 to 16,000 tons, equipped with towing winch and towing cable, is chartered to arrive at the terminal on a fixed date. Also two tugboats are required to assist in keeping the towing vessel in the line of pulling. Two or more work launches are necessary to stand by for hauling wires to shore and for transportation; one of the launches carries diver's pump and equipment. In the sea two large marking buoys are placed 200 feet on each side of the spot proposed for the end of the sea line. About 2,500 feet to seaward is anchored a single large guoy with flag aligned with the pulling strip to assist the towing vessel in keeping direction. A final preparation is to lay a 5-inch circumference wire cable on the sea bed in a straight line with the pulling strip from the 20-ft. contour line, where the end is buoyed, to the shore line below the throat. The shore end reaches to the landward side of the dolly pit. The seaward end of this wire will be shackled to the towing vessel's cable which will then be hauled ashore by a tractor. It is most essential that the wire be laid in a straight line as the vessel's heavy towing cable will follow in the track of the wire; likewise, the sea line when pulled will follow in the track of the towing cable. On the day appointed for the pulling of the sea line all equipment must be in readiness. Several tractors with side-booms are standing by for emergencies; men are placed along the track every 70 feet to keep the dollies in place should the pipe commence to vibrate and "jump"; others are placed in the dolly pit to haul away dollies. Two barrels of grease should be kept near the throat with enough men to apply the grease freely as the pipe slides through the aperture.

The towing vessel is boarded by a master mariner who is experienced in the pulling of sea lines and has a thorough knowledge of the engineering side of the operation. He takes charge of the vessel and proceeds to the pulling strip where an anchor is dropped in line with the shore targets. The vessel is swung stern toward land. The end of the towing cable is shackled to the pulling wire and hauled to shore, where it is shackled to the swivel in the bridle. From shore is signalled over the radio "We are ready," and a flag is hoisted. The vessel replies with a flag and signals "We are heaving in towing wire." When there are 1,000 feet of wire out, the winch drum is set on the hand brake in readiness for immediate release. The vessel signals "We are going ahead," and from shore is received "All clear." The two tugboats are ordered to opposite sides of the vessel's bow, where the bow of each is made fast and while the vessel's anchor is heaved in the vessel is maneuvered in a straight line with the targets over the track on shore. The vessel's engine is given "Dead slow ahead" and as tension comes on the towing cable speed is increased to "Slow ahead." The pipe on the dollies moves forward. An attempt is made to keep the speed of the pipe at 180 feet per minute, and as it is pulled out to sea and the friction on the sea bed causes the pull to be heavier, the speed of the engine is increased. If an emergency arises, the flag on the shore signal station is pulled down, the vessel's engines given "Full astern," the brake on the winch is released and the cable is allowed to run slack. Accidents are few if the vessel is well handled, but vibrations of the pipe line on the dollies may cause it to "jump" and the dollies may become stuck or pile up.

If the sea line is pulled in two sections the "Stop pulling" order is given from

shore when the shore end of the pipe has reached the dolly pit. The flags are pulled down, engines thrown astern, towing cable run out and the vessel's anchor is dropped. The second section is rolled over onto the dollies and moved down the track into contact with the first section and the two ends are welded together. This operation takes from one to two hours. Then the flags are again hoisted, anchor is heaved in and the vessel proceeds, now towing a considerable weight. Every 500 feet leaving the shore is reported over the radio to the vessel, then as the marker buoy tied to the end of the sea lines approaches buoys fixing the end location, every 100 feet is reported. Where long pipes are used, the weight is great and the pipe may stop moving although the vessel's engine may go "Full ahead." The engine is then cut down to "Slow ahead" and as the towing cable becomes slack, "Full speed" is given and the momentum of the vessel jerks the pipe ahead. It may also be necessary to have one of the tugboats towing ahead of the tanker if the weight is too great for the tanker to pull alone. The last "100 feet to go" is reported from shore, then "75 feet," "50" and "25." When the shore flag is pulled down, the engine telegraph is thrown "Full astern," wire is released and the anchor dropped and the tugboats are ordered to stop. The end of the sea line should be within a few feet of its planned location. A diver is sent under water to unscrew a plug in the flange on the end of the sea line allowing water to enter the pipe; he also unshackles the vessel's towing cable and signals for it to be hoisted on board.

It is often desirable to have two smaller diameter lines to each berth. The shore end of the line pulled is then listed out of the throat and swung to one side. The whole operation is repeated with the second line. When in position the sea ends of the two lines should be 25 feet apart. The shore ends are tied into a loading manifold.

On the seaward end of the lines, reducers are fitted and eight lengths of 10 or 12-inch flexible hoses totaling 205 feet are connected to each line. The ends of each string of hoses are buoyed. Four moorings are placed in a half circle on the landward side of the sea line ends, and about 1,000 feet from them, as moorings for tankers. Each mooring consists of a buoy about 10 feet wide and five feet high; six 15-fathom lengths of chain about three inches in diameter; and two 5-ton stock anchors, making a total weight of about 35 tons for each set of moorings. Each mooring buoy is fitted with a quick release hook to take the tanker's ropes; there is also a 5-inch circumference steel wire 780 feet long attached to each hook, the other end to be brought to the tanker and used as a preventer.

When the mooring berth is completed the terminal should be ready to ship oil. As a tanker arrives to load, she is boarded by a mooring master who takes charge and proceeds to berth the vessel. Both bow anchors are dropped, the stern swung towards the buoys, and ship's ropes run out to two or more buoys. The vessel is heaved into position so that its loading connections are opposite and about 60 feet away from a small buoy fastened to the end of the sea line marking its position. The hoses are raised to the ship's side with "buoy ropes," one end being attached to the end of each string of hoses, the other end buoyed. The hoses are connected to the ship's flanges by clamps. Communication between ship and shore is by telephone, the main line lying permanently on the sea bed with the end buoyed and lifted to the ship's rail. VHF radio sets are also used. A "stand by" is given, after which the valves are opened and a loading flag is hoisted. As soon as oil is received in the vessel's tanks, a second flag is hoisted indicating "full speed."

As an indication of the magnitude of a sea line pulling operation, some figures from Tripoli, Lebanon, are given where two sea lines were pulled in May 1950. The pipes were 16-inch outside diameter, of ⅝ inch wall thickness, weighing 106 pounds per foot. The length of each sea line was 7,291 feet, weighing 345 tons. In sea water and empty, each pipe weighed 54 tons, which together with the friction was the weight hauled over the sea bed.

The marine survey for location of a sea line of large diameter, to be floated into position, is the same as for one pulled on the sea bed, but the line may be laid over a somewhat more uneven and rougher ground than pulling would permit.

Where there is a moderately straight and level sea shore within a few miles of the proposed sea line site, the sea line pipe may be welded together into one section and the complete line placed on trestles with skids sloping toward the sea. The blind flange on the end of the pipe, which will be the sea end when in final position, is fitted with a 6-inch gate valve; the other end is fitted with a 3-inch valve.

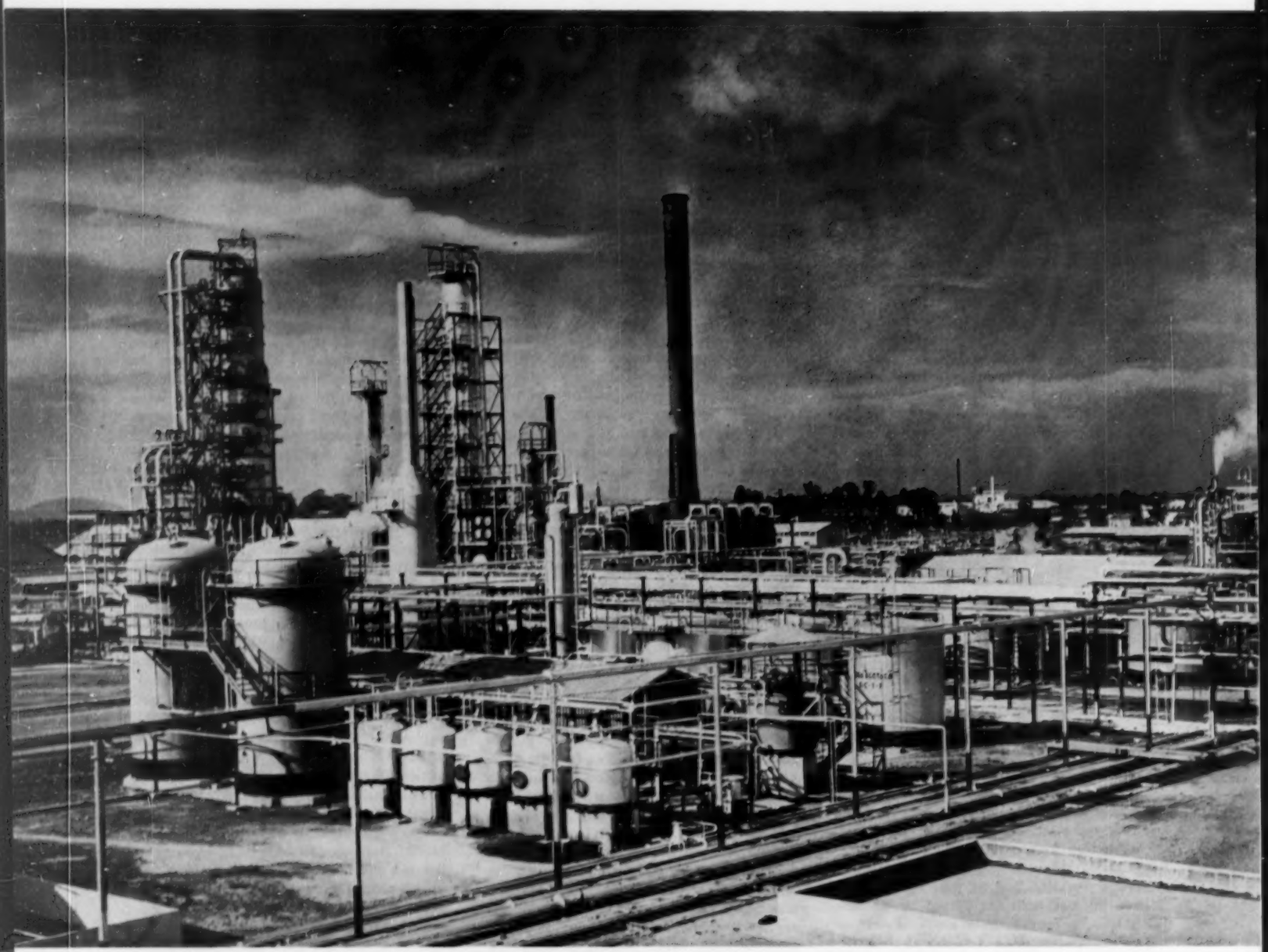
The day for floating the line may be picked at random, for the preparation is considerably less elaborate as compared with pulling a line on the sea bed. There is no costly tanker, no tugboats waiting, and few men are required on shore. Four to six powerful launches must be in readiness, however, and two to four tractors for emergencies. The wind and sea must be moderately calm. The launching of the sea line is done by knocking loose chocks holding the pipe on the trestles and the line rolls into the sea. In the case of a chock jamming, a tractor with side boom will lift the pipe clear. Where the sea end of the line is fitted with a heavy flange and valve, it may be necessary to buoy it by fastening a length of large diameter and lighter pipe on each side of the sea line end to act as a pontoon. Towing launches will fasten their tow ropes to the sea end of the line, which is then floated well out to sea beyond the proposed sea line end location. The towing launches cast off their two ropes and proceed to the shore end of the line where tow lines are fastened and the pulling toward shore begins. Several large buoys are anchored in the position where the line is to be sunk and as the line is manouvered alongside each buoy, it is held in place by ropes.

A work barge is anchored at the proposed sea line end and a heavy flexible wire is fastened to the pipe. The gate valve is opened and, as water enters, the pipe gradually sinks. The wire fastened to the pipe must be held tight by turns around a bollard permitting the pipe to be lowered slowly to the sea bed as it fills. This is necessary as, without the wire, the end of the pipe would sink too fast, producing a great stress on the pipe farther in and possibly kinking it before the end comes to rest on the sea bed. As the pipe sinks gradually towards shore, the ropes holding it to the buoys are slacked away.

Where the contour of the coast line does not permit a long sea line to be welded together for handling, the line may be launched from a pulling strip with grading, track, dollies, dolly pit and throat, but there is no sea sled and the sea end of the pipe may be buoyed if required. The line is pulled out to sea by a tractor on each side pulling on wires fastened to the shore end of the line.

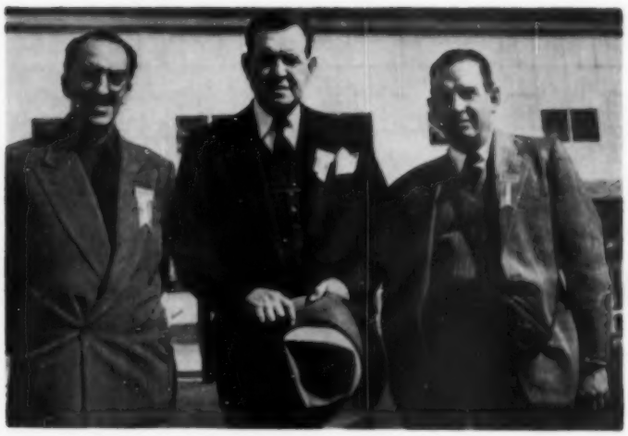
The pulling strip on land need not necessarily be in the direction of the proposed location of the sea line when in place. A powerful launch is required at the sea end of the pipe to maintain its position in line with the pulling strip. When the whole line is floating the procedure for placing it in position is the same as that of launching the line from a beach parallel with the seashore line.

The floating of a sea line from this position is easily the safest, simplest and most economical. The advantage of floating a sea line into position from a pulling strip as compared to pulling it on the sea bed is mainly that one pulling strip may serve to float any number of lines out, thus eliminating the heavy cost of a pulling strip for each line, also the cost of chartering a tanker and tugboats. At Banias, Syria, six sea lines were floated from a single pulling strip to positions in six berths. The lines were of 24-inch diameter, ½ inch wall thickness, weighing 125.49 pounds per foot. The longest line was 6,882 feet, weighing 386 tons. The weight of sea water which the line would displace when submerged being 201 pounds per foot, the line floated 38 percent above water and 62 percent under water.



*Left, the vacuum distillation unit, and right, the crude oil atmospheric distillation unit at Pemex' Salamanca refinery.*

# PEMEX INAUGURATES NEW LUBRICATING PLANT



*Left to right, Ing. Ortiz Mena of Pemex, H. E. Widdell, president of Arthur G. McKee Co., and T. G. Elder, McKee representative in Mexico.*

**By Eudora Garrett**

WHEN Mexico's President, Adolfo Ruiz Cortines, formally inaugurated the new lubricating oil refinery of Petroleos Mexicanos at Salamanca, Gto., early in 1955, the Republic entered a new era of its history. Production from recently completed units at the refinery assures the country of abundant supplies of top quality lubricants of around 90 different types for the first time. Import of these products cost around $15 million in recent years.

Cost of the new lubricating plant, termed by experts one of the most modern, efficient and flexible in the world today, totaled 310 million pesos in national currency, around $30 million estimated through old and new rates of exchange. Total amortization of the investment is expected in a short time, some observers claiming in as brief a period as three years.

Financing was effected with a 56 percent credit granted by the National Savings Bond Board, with the remaining 44 percent taken from the resources of Petroleos Mexicanos. The refinery thus becomes one of the first great industrial projects financed in its major part through savings of the Mexican people, an objective profoundly desired and urged by recent governments.

According to figures released by Pemex, the refinery can handle from 10,000 to 14,000 b/d of reduced crude piped from the Poza Rica field. At capacity production, 2,200 b/d of finished lubricants will be produced.

The town of Salamanca was chosen as the site of this No. 1 refinery because of its location in the center of the country, in the rich agricultural and growing industrial region known as the "Bajio." Salamanca also is the hub of an excellent communications network of highways, roads and railways which simplifies distribution problems in this part of Mexico.

The history of the refinery is one of slow, steady growth over a period of ten years. In 1945, Pemex acquired the site and in July 1950, President Miguel Aleman conducted inauguration ceremonies of the "Ingeniero Antonio M. Amor Refinery," although the plant was not put into operation until October of that year.

Elements of the new lube plant include the following:

1) A vacuum still of 14,000 b/d capacity, for preparation of lubricating oil base stocks.

2) A deasphalting plant, with a capacity of 2,800 b/d. This process employs liquid propane which dissolves oils but not asphalt. It renders two oils, a light No. 40 and the heavier "bright stock." Treated further, both oils give four others which, when mixed with those obtained in the vacuum distillation process, form raw material for producing a complete line of lubricants.

3) A furfural extraction unit, for removal of aromatic hydrocarbons from the lubricating oil base stock.

4) Dewaxing and paraffin purification plant which utilizes methyl-ethyl ketone (MEK) as the solvent which dissolves oils but not paraffin. At full capacity this plant will produce 2,400 barrels of oil from which paraffin has been removed, 23,000 pounds of pure paraffin and 116,000 pounds of another type.

5) A plant for treatment of oils by means of special clays.

6) A re-distilling plant for further treatment to improve color of oil base stock and make it resistant to oxidation.

7) A mixing plant, with complex facilities for additional refining of oils.

8) Auxiliary installations such as the electric power plant, tanks, water system, emergency gas disposal unit and others.

The Arthur G. McKee Co., engineers and contractors of Cleveland, Ohio, collaborated in the basic design, engineering and procurement of materials for the Salamanca refinery, while the entire construction work and much of the engineering was performed by Pemex technicians and workmen. More than 1,000 men are employed at the plant.

Inauguration ceremonies of the Salamanca refinery were considered the most impressive ever held. More than 3,000 visitors attended the event. Accompanying the President and Director Bermudez were various cabinet officials, governors of several states, members of the Mexican Congress, army officials, union leaders and scores of business and industrial leaders.

British Ambassador John Sullivan congratulated President Ruiz Cortines on this additional "expression of Mexico's progress." Many representatives of the oil industry of various countries were present, all welcomed by Guanajuato Governor Jose Aguilar y Maya.

Director Antonio S. Bermudez' speech at the inaugural ceremonies highlighted in graphic detail the importance of Pemex in the national life of Mexico. His concluding remarks are reported as follows:

"The constant discovery of new reserves permitted us to realize a greater daily production at the end of 1954 than was originally calculated. We had predicted a daily production of 250,000 barrels for December 1954, and it actually reached 265,000.

"Domestic consumption totals at present 170,000 barrels a day, which demonstrates that the nation is properly supplied.

"There is still a large margin left for exportation, which will provide an important source of dollar income. During 1955 we will export more oil than during any other year in the history of Petroleos Mexicanos. We have reason to believe that this exportation will exceed 100,000 barrels a day."

# The turbine drilling system and its application

*Dr. Rosu's article in our March issue covered the development and application of the turbine drill in the U.S.S.R. and satellite countries. In this second part of his study he discusses the drilling fluids and pumps required by the method, together with an examination of operating results gleaned from Soviet sources.*

**By George Rosu**

FROM THE previously discussed mechanics of the turbodrill (WORLD PETROLEUM, March 1955), it is obvious that the drilling fluid in this method has a far greater importance than in conventional drilling. With the exception of the function of absorbing the heat generated by the frictional stress in the drill pipe (which has been avoided), the mud stream fulfills all the functions assigned to it in rotary drilling and, in addition, must generate hydroelectric energy by rotating the turbine's elements. The properties of the drilling fluid are, therefore, dictated by the requirements of the turbine, by the higher penetration rate, and by the pressure on the drilling bit. The sources of information available do not indicate that Soviet technicians have found a formula to control the mud composition on a scientific basis. In its present stage, it appears that this matter rests rather on a trial and error basis.

The qualities of the fluid used in turbodrilling are, however, somewhat different from those of the conventional drilling mud. Firstly, it must have a lower sand content (in no case higher than five percent) in order to prevent rapid wearing of the turbine's elements and of the pump liner. Secondly, since the fluid used in turbodrilling must have a higher flow velocity, it should have a lower density and viscosity. While no general rule seems yet to have been discovered in Soviet Russia, viscosity is presumably kept below 10 centipoises. Thirdly, the degree of hydration must be higher: it should contain a lower percentage of clay with a view to obtaining maximum cooling effects, and be supplied at a lower initial temperature. Although the ascending fluid need not absorb the drill pipe's frictional heat, its temperature is none the less higher than in rotary drilling. The heat developed by the drilling bit is noticeably higher because of the higher penetration rate: the heat generating factors being the more rapid stream flow and the greater energy expended in lifting the drill cuttings to the surface. The fact that the turbodrill cuttings are finer than in rotary drilling does not appreciably alter the over-all mud temperature.

Development drilling carried out in 1953 by and within the confines of the Tuymazaburnefti Trust, as well as in some other districts of the "Second Baku" region, claimed to have attained very good results with lighter fluid. Ninety percent of a 5,346-foot hole was drilled with water instead of drilling mud. The penetration rate officially indicated per turbodrill per month was between 2,300 and 3,280 feet. The mechanical explanation volunteered was that water has a lower resistance in the turbine, in the well hole and in the pumps. The fluid flow in the turbine was higher, thus raising the pressure on the floor. It is claimed that the use of water as drilling fluid increased the mechanical drilling speed by 73 percent. In addition, the life of the tool was appreciably lengthened, while pump wear was reduced to half the previous records.

The higher the flow velocity, the greater the speed of the pumps. The load put on the pumps is, therefore, higher than in conventional drilling because the pumping installations double as power equipment. While it is true that the pump engines must develop little additional power over and above that normally required to circulate the drilling fluid, the pumps must nonetheless be more powerful than in rotary drilling: they must be capable of securing a fluid stream of between 650 and 950 gpm, under great pressure.

A prime requisite for achieving more complete use of the hydraulic energy of the mud stream for the mechanical effort as well as for easing the load put on the pumps, is that fluid power losses along the entire mud-circulating system be kept at a minimum or avoided altogether. The drill stem must be designed for attaining the highest hydraulic efficiency. In order to serve the same circulating purposes, the drill pipe has a larger diameter than the pipe used for the same depths in rotary drilling. (A Soviet source mentioned that with a combined string of 6⅝-inch and 5 9/16-inch one

# in the U.S.S.R.

could, theoretically, drill to a depth of up to 13,000 feet.)

In Soviet practice, the slush pumps are run in parallel. This method, apparently, gives the optimum combination of fluid volume and smooth flow.

Among the mud-circulating pumps used in turbine drilling, the only figures at present available are on the "Ideal" pump. The pump is electrically operated, and the motor operates at about 735 rpm. The results are tabulated below:

| Rotation of the bent arbors: No. of strokes/ minute | Diameter of the pump liner in inches | | | | | |
|---|---|---|---|---|---|---|
| | 7¾ | 7¼ | 6¾ | 6¼ | 6 | 5 |
| | Flowrate of the pump in gpm | | | | | |
| 55 | 697 | 602 | 523 | 444 | 404 | 269 |
| 51.5 | 650 | 571 | 491 | 412 | 380 | 254 |
| 47.5 | 602 | 523 | 444 | 380 | 349 | 229 |
| 43.5 | 550 | 476 | 412 | 349 | 317 | 213 |
| 38.5 | 491 | 460 | 366 | 309 | 285 | 190 |
| 35 | 444 | 380 | 333 | 277 | 254 | 166 |

From the Soviet sources available, it appears that up to the present time, the optimal dimensions of the mud pumps needed in turbine drilling are not known, and experiments are still going on. The latest model of Soviet mud pump, called U8-3, of which the first examples were constructed approximately three years ago at the Machine Construction Works in the Urals, seems to represent real progress. It is expected that the use of the U8-3 will permit considerable increases in the drilling speed.

• The information gathered from the available Soviet sources regarding the operational results is sketchy and wanting both in completeness and clarity. No answers have been found to such questions as:

1) Frequency of drill pipe sticking.

2) Effects of the turbodrill fluid upon special formations (permeable formations, etc).

3) Dimensions and behavior of the hole while piercing various strata, sections and seats.

As a rule, Soviet publications are crowded with discussions about theoretical ratings and fundamental equations, but very reticent about practical results. While the usual Soviet secrecy may not be discarded altogether as the major reason for this lack of information, it may be assumed that, in spite of recurrent praise in the daily press, the turbodrill is, in Kapelyushinikov's own country, still in the experimental stages.

The evaluation of official remarks with respect to turbodrill operations is quite difficult, inasmuch as it is not known whether they include only selected variables or whether they are based on operations in a wider variety of formations and depths.

Drilling speeds are much higher than in rotary drilling. The penetration rate recorded is between one and one half to two times as high—even above 33 feet per hour. The mechanical speed of the tool at its theoretical maximum may reach as high as 320 feet per hour, but penetration rate depends to a great extent, of course, on the chosen drilling program.

The most important factor in turbine drilling is the weight on the bit, since this determines the rotation of the turbine and thus of the drill bit. When piercing the same kind of formation, the rotation decreases if the pressure on the bottom is lowered. It is, therefore, required that the drilling foreman be constantly on the watch because the various elements of the drilling conditions (fluid rate, pressure on the bit and bit rotation) are no longer separately adjusted but depend on each other.

It is presumed that the devices used for weight control in Soviet practice are manual feed-off devices and weight indicators of the bottom-hole type, although Soviet sources are unclear on this point. The turbine drilling assures a comparatively more constant load on the bit because the rotation and whipping of the drill pipe has been abolished. A manual weight control device seems thus to be indicated, provided that the driller is experienced in handling it.

It is obvious that here, more than in rotary drilling, the progress and smooth functioning of the turbodrill depend largely on the driller's skillful performance of his duties. The goal is to secure a maximum penetration speed through a constant pressure on the bottom. For this purpose, the drilling foreman, after he had applied a certain initial pressure on the bit, follows the fluctuation on the weight control dial. The weight on the bottom decreases concurrently with the rock piercing, and as a greater part of the turbodrill's weight is suspended on the handling hook, the weight reading indicator will move clockwise. If the pointer moves slowly, it denotes slow drilling progress, and the pressure on the bottom must be increased. Through varying this pressure, a stage is reached when the pointer advances swiftly. It is in this way that the maximum penetration speed and optimal drilling conditions can be determined for a given formation.

It is further stated by Soviet sources that, in clay and limestone, the pressure on the bit is low, but the rotation speed high. In hard rocks, the procedure is reversed. The experimental drillings carried out at Vtoroi, Baku, showed that when drilling through the local hard rocks it was preferrable to apply a less strenuous drilling regime. Best results were attained with a fluid flow of 350 to 380 gpm, a pressure of 515 to 660 psi, and a bit rotation speed of 300 rpm.

Successful drilling with the turbodrill at great depths depends on the fulfillment of the following conditions:

a) Use of pumps with large fluid volume and high pressure (between 1,700 and 2,900 psi).

b) Lighter drill pipe than that used in rotary drilling, but of a larger diameter.

c) Use of three con bits adequate for extended work at high rotation speed.

d) Reamers constructed for high rotation.

e) Discharge pipes designed for high pressure and large fluid volume.

The use of fishtail bits in turbine drilling is confined to very soft formations. In medium hard and in hard rocks roller bits are used exclusively and, above all, three con bits.

The use of the three roller reamer in the finishing job has not shown satisfactory results. It has been, however, successfully replaced with the reamer with one roller.

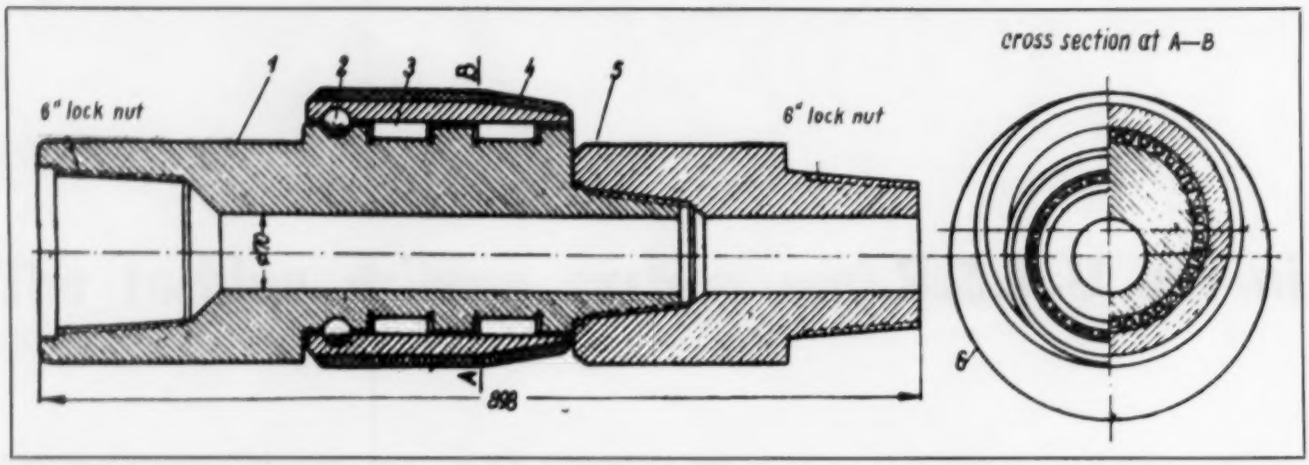



*Figure 10. Reamer with one roller of 11¾ inches. 1) Case; 2) ball bearing; 3)roller bearing; 4) lugs with cutting edges; 5) reduction; 6) borehole diameter.*

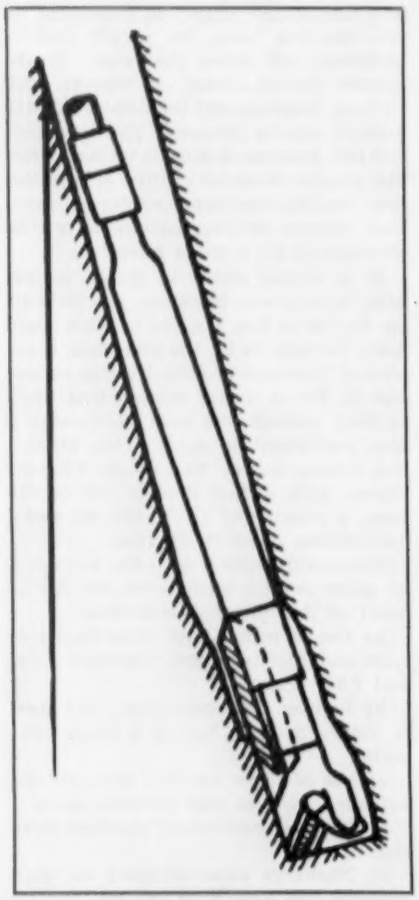


*Figure 11. Directional drilling with turbodrill.*

In order to drill a perfectly straight hole, Soviet practice has proved it is best to introduce a heavy rod between the turbodrill and the bit.

It is further claimed that turbine drilling has shown far better results in directional drilling than rotary drilling with a whipstock. For this purpose, the turbodrill is lowered on a bent rod or on a special deviated groove. In this way, the borehole can easily be directed in the chosen direction.

One Soviet source claims that the first directional well was experimentally drilled with a turbodrill at Baku as early as 1941; that directional drilling has more recently undergone great development in the Crasnocamsc region, and that penetration rates attained were equal to those obtained in drilling straight holes. It is further claimed that turbine drilling is very efficient in drilling wells at an angle from the Caspian shores into the oil deposits below sea level.

Soviet sources claim also that turbine drilling is steadily on the increase and that the "turbobur" is presently being used in developing most of the "Second Baku" fields. The only place outside Russia where the turbodrill is in use is in Romania. The first experiments started there in May 1952. According to official sources, by the end of 1953 there were eleven turbodrills at work in Romania. While these tools might be used for experimental purposes in the Romanian southern fields (at depths of 9,000 feet and over) it is, however, positively known that turbodrills are used in actual operations only in the Bacau region where the oil-bearing formations are at a shallow depth (2,000 to 3,000 feet). Official Romanian sources claim that the drilling speed reached is far superior to the levels attained with rotary rigs, and that the life of the drill bit is twice as long as that recorded in conventional drilling.

• The increased demand for oil products requires constant improvement in drilling methods. The challenge of rising consumption must be met by challenging Nature. Tools must drill faster and be able to reach deeper deposits through holes drilled under conditions that once appeared prohibitive. For 54 years, the rotary drilling process has been greatly mechanized and improved on. But like any other creation of the human mind, it has both its lights and shadows, well known to the oilman. The competition of other fuels, the pressure of demand as well as greater technical difficulties in the field require tools with which to drill faster and cheaper than hitherto.

Since the 30's, however, the rotary rig has not been subject to any great transformations, and it seems that no revolutionary changes may be expected to occur in the foreseeable future. Human inventiveness strives, therefore, to find elsewhere new solutions to new challenges. There are three new methods which are presently claiming the attention of the oil technicians: the turbodrill, the electrodrill and what may be called the electronic vibration method. All three contain a revolutionary idea which developed as a by-product of the general advance of the science.

Whereas the latter two methods may still take many years of development and experimenting, the turbodrill is already a practical tool. In addition to the advantages mentioned earlier, there are several more items that may be entered on the right side of the ledger for the turbine drilling method:

a) Portable and mounted rigs may be advantageously used because the rig does not have to handle the heavy strings of casing necessary in the rotary system when drilling through unconsolidated sands and caving formations. The mounted rig may be used to drill holes in excess of 3,000 feet. Experiments made at

Bacau, Romania, seem to have given satisfactory results.

b) Turbine drilling dispenses with rubber protection against frictional wear of the drill pipe as well as with costly anti-friction tool joints and collars.

c) With the exception of the pumps, the surface equipment is lighter and less costly, and the life of the rig components is substantially lengthened.

d) Turbine drilling produces straighter holes and is more efficient in directional drilling. The erratic motions of the bit are, to all intents and purposes, avoided.

e) The hole gauge does not noticeably deviate from the bit's diameter.

f) The occurrence of many types of accidents is averted, or their effects considerably reduced. Among these are: twist-off accidents, the dropping of pipes and collars in the hole and the frequent connection failures of tool joints and drill collars.

On the debit side of the ledger, the greatest single question mark is the cost of turbine drilling. First of all, the turbodrill is a complicated tool and its construction cost—while not prohibitive—is still very high for its servicing life. There is yet no clear-cut answer to the question whether the turbodrill has, without any reservations, an economic life.

As to the well cost, the answer is even more in the realm of speculation. A synopsis of rotary drilling costs will show that few circumstances which cause unpredictable increases in cost are absolutely eliminated in turbodrilling.

From among the specific circumstances (depth and nature of formations to be pierced, driller's skill, diameter of the hole and casing requirements), none has been eliminated or their impact reduced. The question whether turbine drilling can be run on casing alone is still but a theoretical speculation. There is no report to date that this method has been successfully experimented within the Soviet orbit. If this proves, however, to be feasible, then the resulting saving in equipment cost and handling would considerably upset the accounts in the turbodrill's favor.

Of the fortuitous circumstances, only the accidental loss or breakage of a tool in the hole has been practically eliminated. Nevertheless, since caving and heaving of formations is not excluded in turbine drilling, the possibility of fishing jobs still exists. The collapse of the casing, unsuccessful water shut-offs, blowouts of high gas pressure and other fortuitous circumstances are not eliminated either.

Finally, the variable and additional expenses are, practically, the same as in rotary drilling. Even the power consumption is not appreciably lowered, since whatever power is saved in the rig is used by the more powerful pumps.

Some of the overhead expenses, however, are amortized by a series of items whose cost is lower than in rotary drilling, and by a better performance in the field. Costs are lowered through lighter surface equipment, lighter drill pipe and longer useful life of the drill stem. An even greater saving may come from the turbodrill's higher penetration rate.

Further savings and advantages may occur if, and when, the turbodrill is perfected for exploratory drilling. For this purpose, it is necessary to construct a tool with a smaller diameter and one capable of developing a higher speed than the present turbodrill.

• In the Soviet orbit, the use of the turbodrill is steadily increasing. The recent expansion in the Eastern oil regions has been due mainly to the use of this tool. It is officially claimed that no less than 80 percent of the development drilling performed in these regions is presently done with the "turbobur." It is further claimed that it has reached speeds of up to 1,700 feet per month per outfit in softer formations, and that the deepest well drilled so far with this tool reached 16,400 feet.

One should, of course, not loose sight of the fact that its increased use within the Soviet orbit does not necessarily warrant the uncritical acceptance of this method by the non-Soviet world, for, in the USSR and its satellites, speed and pressing strategic reasons have priority over economics.

There are even a few Soviet technicians who admit that, if judged by its present performances in the field, the turbodrill is far from being an economic tool. Teams of technicians are incessantly working for its improvement. They have not yet discovered the best material from which to construct a sturdy and lasting tool nor the optimal dimensions, form and power generating capacity of the pumps best suited to serve the turbodrill. The ideal formula of the third vital element, the drilling fluid, remains also to be discovered. Recent improvements in materials and blade design have raised the turbine's efficiency, but there is still a long way to go in this direction. Much hope has been attached to the new U8-3 pump, but no information is available to date as to whether this "wonder child" of Soviet technology has fulfilled these hopes.

Soviet turbodrill operators are plagued, above all, by troubles with the drilling bit. In order to cope with a greater speed and some specific operating conditions, the turbodrill's bit must be made of a steel of unusual strength.

Inferences drawn from the guarded language of the Soviet press reveal that steel of such particular hardness is an extremely short commodity in Russia. Bits produced from conventional alloy steel obviously failed lamentably in the field. A particularly scornful editorial in *Pravda* of July 3, 1953 stated that only one of the four main works producing turbine bits put out half-way satisfactory products, and that bits of a "new design" could not be produced because of lack of special steels.

During the second half of 1953, news items reporting failures in turbodrill operations could be found quite frequently in *Izvestia*, *Trud* and *Bakinschii Rabochii*. Almost all of them were due to bit trouble. In the softer Tertiary formations of the Baku region, the average use was one bit per 620 feet drilled. In the Bashkir Republic, however, this average ranged from 62 to 46, and even six feet per bit, which is an unprecedently high frequency in bit use even for the hard formations of the Ufa region. A few similarly pessimistic reports seeped out in the press also in 1954. The impelling conclusion is that Soviet technology is still far from solving this major obstacle in turbine drilling.

Unless the bit's useful life is lengthened, most of the advantages of turbine drilling over the rotary method are cancelled. Western technology should easily be capable of correcting not only this but also other shortcomings manifested by the turbodrill in Soviet fields. A better technique may more quickly develop the great potentialities of this tool and thereby demonstrate that turbine drilling may take its place in the industry as an economical drilling method.

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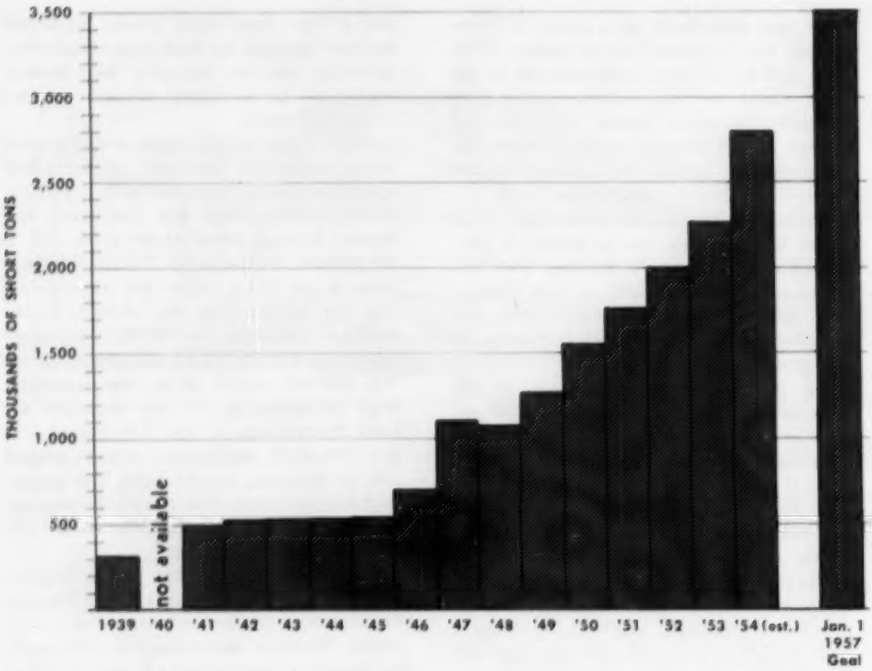
Note: All technical data found in the documentary sources and expressed in European standards and in the metric system have been transformed into U. S. equivalent standards according to the indications given in *Handbook of Chemistry and Physics, 30th Edition*, 1947, Chemical Rubber Publishing Co., Cleveland, Ohio.




*Graph shows U. S. ammonia production figures by years. Goal of the Office of Defense Mobilization is a yearly production of 3½ million short tons of fixed nitrogen by January 1, 1957.*

# *Ammonia* — a rapidly growing petrochemical

THE PRODUCTION of ammonia in the United States has increased 250 percent since the close of World War II. The rate of increase is expected to continue for a number of years until the petrochemical industry adequately supplies the rapid growth in agricultural and industrial demand. New techniques in application of ammonia to the soil, modifications in manufacturing processes, and the recent availability of by-product hydrogen at oil refineries have combined to stimulate plant construction.

Although ammonia manufacture outside the United States has not grown as rapidly, there are many indications that a similar expansion soon will take place in Latin America and the Eastern Hemisphere. A considerable number of plants are being considered, particularly in areas where natural gas is available and is not now being fully utilized.

Ammonia was isolated as early as 1774 when Priestly heated lime and ammonium chloride to form "alkaline air," but the first synthetic ammonia plant using the Haber-Bosch process which reacted hydrogen and nitrogen (from semi-water) under pressure and over a catalyst, started in Germany in 1913. This basic Haber process is now common to all present commercial processes. Principal variations in current plants consist in the way hydrogen and nitrogen are prepared.

Ammonia was produced in the United States before 1920 with limited success principally from semi-water gases. The first commercially successful American plant was placed on stream by Atmospheric Nitrogen Corp., a subsidiary of General Chemical Corp. and Allied Chemical & Dye Corp., in 1921 at Syracuse, N.Y. Semi-water furnished the hydrogen for the great bulk of ammonia production until World War II.

The use of natural gas as a raw material started shortly prior to 1940; in that year about eight percent of all ammonia was produced from that source. In the following 10 years, the cost advantages of using natural gas gave it strong precedence over competing raw materials.

While only small portions came from natural gas 15 years ago, just above half of all production came from it in 1952. The proportion from natural gas rose to 80 percent in 1954 and is still going up. That coke-oven gas appears outdated is confirmed by Allied Chemical's move last year, when it changed its Hopewell plant to natural gas. There now remain only two coke-oven gas ammonia plants in the country.

Several refineries in the past year have announced their intention to use by-product or reformer hydrogen to make ammonia. Atlantic Refining Co. completed a 100 ton/day plant in Philadelphia in mid-1954. Standard Oil Co. (Ohio) has plans for a 300-ton plant at Lima. Shell Oil Co. at Pittsburg, Calif., is currently expanding its ammonia facilities. Dow Chemical Co. (Canada) is also expanding its facilities, part of which are to be based on by-product hydrogen. The most recent move in this direction is that by Sinclair Refining Co. and Standard Oil Co. (Ind.) which have joined to build a 300-ton plant at Hammond, Ind. Both companies will market their common output early next year when the plant comes on stream. Sun Oil Co. late last year announced plans for a 300-ton plant for late 1955 opening.

Another source of by-product hydrogen is that from the synthesis of acetylene out of natural gas. Electrolytic hydrogen also contributes some small amount to the production of ammonia. Since 1945, two of these plants have been constructed. Late last year, one firm announced that it would use coke-oven gases from its steel mill operations to produce ammonia.

In 1955, it is expected that Bunker C fuel oil will come into use as a source of hydrogen to produce anhydrous ammonia. Two such plants are now in the preconstruction engineering stage. The process will be of particular value in areas where natural gas is either unavailable or its

supply is interruptable. The process is a development of partial oxidation for the non-catalytic production of synthesis gas from fuel oil.

Northern Chemical Industries of Baltimore, Maryland, has announced that it will build a $9 million ammonia plant at Searsport, Me. It will be the first plant using exclusively the Texaco-Hydrocarbon Research process for producing ammonia synthesis gas from Bunker C fuel oil by partial oxidation with oxygen. The nitrogen will, as in all other plants, be obtained from the air. The installation will include a 125-ton anhydrous ammonia plant, a 60-ton nitric acid plant and a complete nitrogen solutions plant along with a 7,500 kw power plant.

The second fuel oil plant is to be built by Columbia River Chemicals, Inc., at Pasco, Wash.

Thus far, the use of anhydrous ammonia for direct application to the soil has not been practiced in New England as in other parts of the country. The topography of the area does not lend itself as well to this particular use as the mid-western plains, but with ammonia readily available from the Searsport plant, it is believed that farmers in the area to be served will materially increase their nitrogen consumption via such derivatives as nitrogen solutions and sulfate of ammonia.

Capital costs for the production of anhydrous ammonia, measured by a rough rule of thumb, range from $200 per ton per year upwards, depending on plant size. According to one of the largest producers from natural gas, the smallest economic plant last year was estimated to be in the range of $10 million. For a plant of this size to run efficiently and economically, it should be operated 350 days a year. Accordingly, ammonia plants carry a high premium on maintenance and efficiency—as well as in storage facilities, this manufacturer stated.

Of the many reasons adduced for the rapid growth in productive facilities since the war, one of the principal ones is the ready availability of low cost hydrogen from petroleum, natural gas, or refining operations. The increasing demand for higher octane gasoline has brought forth various reforming processes (Catforming, Houdriforming, Platforming, etc.) now having around one million barrels per day of capacity. These processes produce large quantities of hydrogen that may be burned for cheap fuel, employed for desulfurization of distillates or turned into a high-priced quantity product, such as ammonia.

To encourage the production of nitrogenous materials, the Office of Defense Mobilization (ODM) has granted certificates of necessity for rapid write-offs of capital investments in nitrogenous fixation plants in an attempt to bring domestic capacity to 3.5 million tons by January 1, 1957. As of last September, industry had taken advantage of this privilege to attain the government-established goal, although substantial capacity yet remained to be built. Moreover, several major companies—without the benefit of certificates of necessity — have announced their intention of putting up their own ammonia plants.

The annual production of anhydrous ammonia in recent years is shown in Table I.

Table II lists the ammonia plants in operation at the end of the year, and those yet to be built. Capacity of the plants yet to be built under certificates of necessity amounts to 278,000 tons of nitrogen (340,000 tons ammonia). The ODM goal of 3.5 million tons by 1957 is sure of being surpassed according to these two lists, as total capacity, actual and planned, now amounts to 3,750,000 tons.

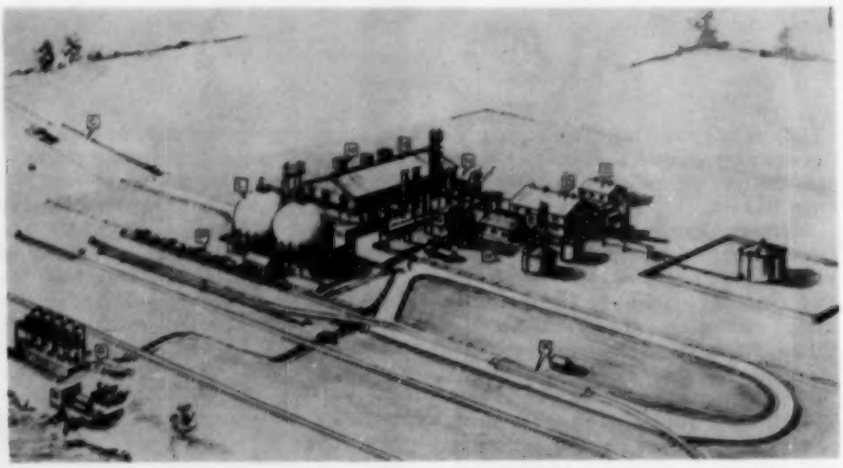
According to government economists, production will be greater than demand for the next two years, and indeed there were signs last year — judging from selling prices for anhydrous ammonia — that agricultural demand in some areas at least was lower than the supply. Few believe, however, that this situation will become nationwide or be long lived. As

*Panoramic view of a portion of the anhydrous ammonia manufacturing facilities at the Barton plant of Lion Oil Co. at Luling, La. Center building houses compressors, synthesis circulators and refrigeration engines. Towers at left are part of the CO removal system and the superstructure at right is above the synthesis converters.*

**TABLE I**

**U. S. PRODUCTION OF ANHYDROUS AMMONIA**

| Year | Short Tons |
|---|---|
| 1939 | 310,822 |
| 1940 | N.A. |
| 1941 | 501,271 |
| 1942 | 543,352 |
| 1943 | 543,380 |
| 1944 | 543,651 |
| 1945 | 548,655 |
| 1946 | 725,537 |
| 1947 | 1,114,000 |
| 1948 | 1,089,786 |
| 1949 | 1,294,057 |
| 1950 | 1,565,569 |
| 1951 | 1,777,074 |
| 1952 | 2,052,114 |
| 1953 | 2,286,454 |
| 1954 1st 6 mos. | 1,352,734 |
| 2nd 6 mos. (estimated) | 1,450,000 |
| Total 1954 | 2,802,734 |



*Artist's sketch of the anhydrous ammonia and nitrogen solutions plant of Northern Chemical Industries at Searsport, Maine.*

**TABLE II**

**U. S. AMMONIA PLANTS**

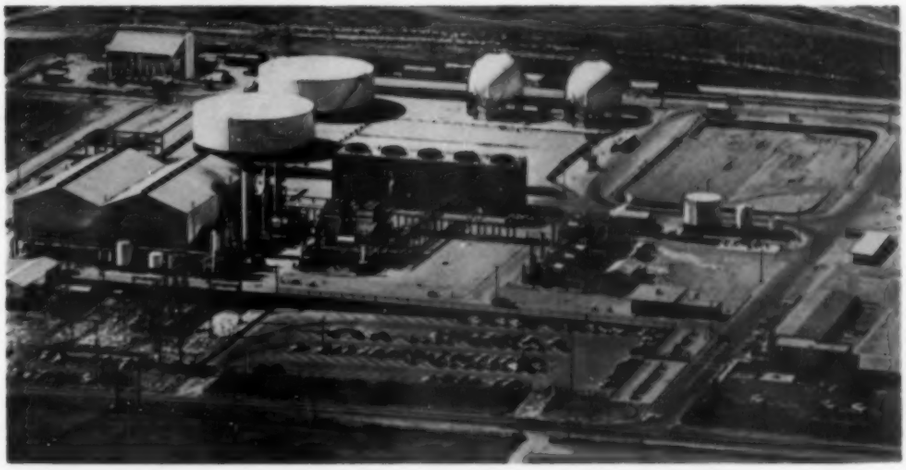
| Company | Location | Operating Capacity | (Tons per Year) Under Construction | Projected |
|---|---|---|---|---|
| Allied Chemical & Dye | Hopewell, Va. | 390,000 | ..... | ..... |
| Allied Chemical & Dye | South Point, Ohio | 273,000 | ..... | ..... |
| Allied Chemical & Dye | La Platte, Neb. | 75,000 | ..... | ..... |
| American Cyanamid | Avondale, La. | 100,000 | ..... | ..... |
| Ammonia Chemicals Co. | Oleander, Calif. | ..... | ..... | Projected |
| Atlantic Refining Co. | Philadelphia, Pa. | 35,000 | ..... | ..... |
| Atlas Powder Co. | Atlas, Mo. | ..... | ..... | Projected |
| Brea Chemical (Union Oil) | Brea, Calif. | 82,000 | ..... | ..... |
| Chillicothe Petrochemicals | Chillicothe, Texas | ..... | 25,000 | ..... |
| Columbia River Chemicals Co. | Pasco, Wash. | ..... | ..... | Projected |
| Calumet Chemical Co. | Hammond, Ind. | ..... | 108,000 | ..... |
| Columbia-Southern (Pittsburgh Plate Glass) | Natrium, W. Va. | ..... | 30,000 | ..... |
| Commercial Solvents | Sterlington, La. | 134,000 | ..... | ..... |
| Coop. Farm Chemicals | Lawrence, Kan. | 60,000 | ..... | ..... |
| Deere | Pryor, Okla. | 63,000 | ..... | ..... |
| Dow Chemical | Freeport, Texas | 80,000 | ..... | ..... |
| Dow Chemical | Midland, Mich. | 24,000 | ..... | ..... |
| Dow Chemical | Pittsburg, Calif. | 4,000 | ..... | ..... |
| du Pont | Belle, W. Va. | 210,000 | ..... | ..... |
| du Pont | Niagara Falls, N.Y. | 9,000 | ..... | ..... |
| Food Machinery & Chemical Corp. | Charleston, W. Va. | ..... | 22,000 | ..... |
| Gulf Chemical Co. | Pensacola | ..... | 72,000 | ..... |
| W. R. Grace | Memphis, Tenn. | 87,000 | ..... | ..... |
| Hercules Powder | Hercules, Calif. | 28,000 | ..... | ..... |
| Hercules Powder | Louisiana, Mo. | 42,000 | ..... | ..... |
| Hooker Electrochemical | Tacoma, Wash. | 25,000 | ..... | ..... |
| Ketona Chemical Co. | Torrant, Ala. | ..... | 45,000 | ..... |
| Lion Oil | El Dorado, Ark. | 210,000 | ..... | ..... |
| Lion Oil | Luling, La. | 105,000 | ..... | ..... |
| Olin-Mathieson Chemical | Lake Charles, La. | 98,000 | ..... | ..... |
| Olin-Mathieson Chemical | Niagara Falls, N.Y. | 7,000 | ..... | ..... |
| Olin-Mathieson Chemical | Morgantown, W. Va. | 210,000 | ..... | ..... |
| Mississippi Chemical | Yazoo City, Miss. | 104,000 | ..... | ..... |
| Mississippi River Fuel | Selma, Mo. | ..... | 72,000 | ..... |
| National Distillers | Tuscola, Ill. | 60,000 | ..... | ..... |
| Northern Chemicals Industries | Searsport, Me. | ..... | 45,000 | ..... |
| Pennsalt Mfg. | Wyandotte, Mich. | 29,000 | ..... | ..... |
| Pennsalt Mfg. | Portland, Ore. | ..... | 15,000 | ..... |
| Phillips Chemical | Etter, Texas | 160,000 | ..... | ..... |
| Phillips Chemical | Houston, Texas | 150,000 | ..... | ..... |
| San Jacinto Chemical (Smith-Douglass) | Houston, Texas | 38,000 | ..... | ..... |
| Simpson Coal & Chemical | Natchez, Miss. | ..... | 60,000 | ..... |
| Shell Chemical | Pittsburg, Calif. | 95,000 | ..... | ..... |
| Shell Chemical | Ventura, Calif. | 54,000 | ..... | ..... |
| Spencer Chemical | Henderson, Ky. | 70,000 | ..... | ..... |
| Spencer Chemical | Vicksburg, Miss. | 70,000 | ..... | ..... |
| Spencer Chemical | Pittsburg, Kan. | 180,000 | ..... | ..... |
| Standard Oil Co. (Calif.) | Richmond, Calif. | ..... | ..... | Projected |
| Standard Oil Co. (Ohio) | Lima, Ohio | 108,000 | ..... | ..... |
| Sun Oil Co. | Marcus Hook, Pa. | ..... | 108,000 | ..... |
| TVA | Wilson Dam, Ala. | 90,000 | ..... | ..... |
| Utah Chemical Co. | Mt. Pleasant, Utah | ..... | ..... | Projected |
| U.S. Steel Co. | Geneva, Utah | ..... | 72,000 | ..... |
| TOTALS | | 3,559,000 | 674,000 | ..... |

agriculture absorbs more than two-thirds of all the ammonia produced, and as this industry should continue at an ever-increasing pace to demand more fertilizer to accommodate our greatly increasing population, demand should be equal to, if not greater than, supply within a few years.

In the case of a national emergency, the present light surplus of ammonia would be radically changed. According to a survey of the nitrogen industry conducted by ODM in the spring of last year, it was shown that the then existing plants, those under construction at the time, and those yet to be built under certificates of necessity up to 1957 could actually produce 16 percent more ammonia than rated capacity. This surplus was arrived at by postulating that production would be more important than costs and plant efficiency and that bottlenecks would be eliminated.

Ammonia is a primary source of concentrated nitrogen suitable for use in agriculture. It contains about 82.2 percent nitrogen by weight. It is a primary raw material for synthetic fertilizers, such as ammonium nitrate, ammonium sulfate, urea, and nitrogen solutions. As a gas, it is also applied directly to the soil.

The agricultural market for ammonia absorbs about 70 percent of all uses and is extremely seasonable. Most sales occur in the first four months of the year. Starting in June manufacturers must store the bulk of their production. In mid-January, sales pick up and mount into a continuous crescendo climaxing in May. It may happen that as much as 20 percent of yearly production must be shipped in one month. The peculiar pattern taxes not only tank cars and other



*Brea Chemicals, Inc., subsidiary of the Union Oil Co. of California, is now producing more than 250 tons per day of ammonia at its new $13 million plant at Brea, Calif. A carbon dioxide plant is also in production (left background) producing 70 tons of dry ice per day. An ammonium phosphate plant is under construction.*

means of transportation, but lays great stress on storage, a costly factor for ammonia. The least expensive form of storage is the pressuresphere, and one capable of holding 1,500 tons costs in the vicinity of one quarter of a million dollars.

Prices for anhydrous ammonia have risen somewhat during the last five years. The current 1954-1955 price is between $85 and $88 per ton. This compares with $82 in 1952 and part of 1953.

Industrial uses of ammonia take about 30 percent of total production. Principal uses are in the manufacture of nitric acid, organic compounds, synthetic drugs, cyanides, synthetic fibers and plastics, and photographic developers. Ammonia is also used directly as a refrigerant, mineral dressing, etc.

Ammonia is manufactured by a half dozen different processes, though each process varies more in its method of producing synthesis gas than in the synthesis of ammonia itself. In many of the ammonia processes, actual synthesis occurs in a reactor containing a catalyst at around 300 atmospheres and 900°F. East pass produces about 22 percent conversion. Unconverted gases are recycled for an ultimate yield of about 85-90 percent.

In the older processes crude synthesis gas from semi-water gas was produced by passing both air and steam over incandescent coke in a suitable ratio to produce hydrogen, carbon monoxide and nitrogen in the desired ratio to result in an ammonia synthesis gas after further shift conversion of the unconverted carbon monoxide with steam to produce hydrogen and carbon monoxide. The carbon monoxide is then removed.

In the more recent processes based on natural gas, nitrogen may be obtained by liquefaction of air and fractionation of oxygen and nitrogen. The hydrogen is obtained by high pressure oxidation of methane. In others, natural gas is thermally or catalytically reformed, followed by steps which involve oxygen removal from air to produce exact hydrogen-nitrogen ratios.

In one of the recently developed processes, natural gas is in part burned at high temperature (above 2,000°F) and pressure (around 400 psig). The resulting synthesis gas contains about 2/3 of the hydrogen necessary for the ammonia reaction. The other 1/3 comes from the shift conversion of carbon monoxide to carbon dioxide and hydrogen in the conventional manner. The carbon dioxide is then removed by scrubbing. The gas is then dehydrated through refrigeration and desiccated before being introduced in a final purification step to a liquid nitrogen wash tower where the last traces of condensibles are removed at minus 300°F.

Nitrogen is prepared from air which is first compressed, liquefied, and fractionated into oxygen and nitrogen. The oxygen is used to burn the methane in the first step above. Part of the liquid nitrogen is used later to purify the ammonia. This step has been a practice in European plants and one company in the United States has used the method for some 20 years. Another part of the nitrogen is added to the synthesis gas in the proper mole ratio of three parts hydrogen to one part nitrogen.

The synthesis gas, containing essentially pure hydrogen and nitrogen in proper ratio, enters the reactor via the jet ejector system at a pressure of about 12,000 psig and a temperature at or about 100°F. The two gases join chemically over a catalyst to form ammonia. Liquid ammonia and unconverted gases are cooled and separated; the ammonia is removed and the gases are recirculated through the jet ejector system.

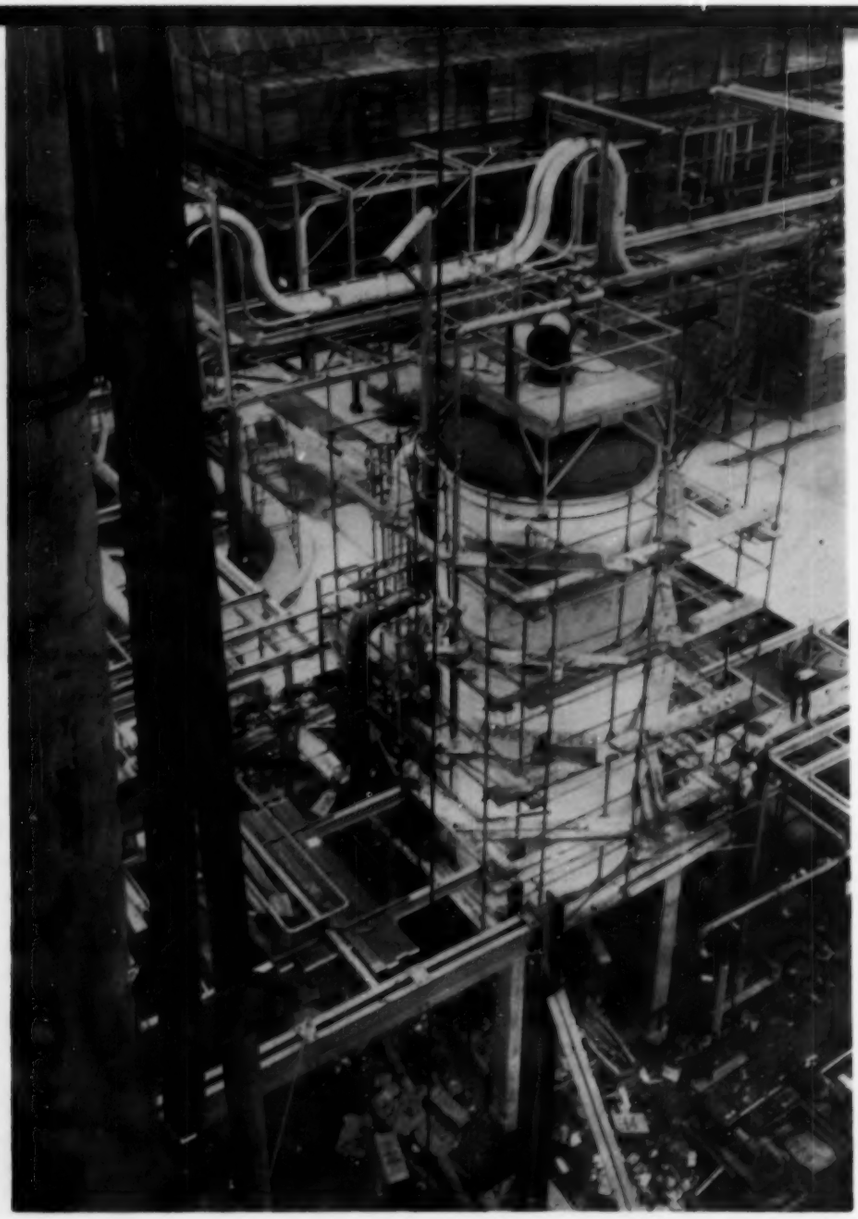
The first anhydrous ammonia plant to use the partial oxidation process came on stream in early 1954 at Vicksburg, Miss.

In another of the newer processes natural gas is thermally reformed with a conversion to about 70 percent raw synthesis gas. This gas is then charged to a combustion chamber where it is mixed with air. Heat of combustion of oxygen in the air completes the reforming of the natural gas. Mixed gases leaving the combustion chamber at about 1,700°F are quenched with water to reduce the gas temperature and provide steam for the shift conversion of CO to $CO_2$. Additional hydrogen is produced to create a proper nitrogen/hydrogen ratio. Carbon dioxide is removed with a regenerative MEA system prior to ammonia synthesis.

Until recently most of the processes employed pressures of about 5,200 psi for ammonia synthesis. In some of the newer plants the final reaction is carried out at pressures ranging from 9,000 to 12,000 psi. In some instances two converters are arranged in series with an ammonia condenser and circulating compressor between. It is reported that with this arrangement recovery of ammonia from the separator following the first converter is about 80 percent. In the separator following the second converter 68 to 72 percent of the remainder is recovered. Residual ammonia concentration in the recycle gas stream is about 4 to 6 percent.

As suggested above, the petrochemical manufacturer has a rather wide variety of processes from which he can choose to meet his individual requirements.

# INSULATION OBJECTIVES DETERMINE MATERIALS AND METHODS



*Insulation application in progress on tar separator where process temperature control is important.*

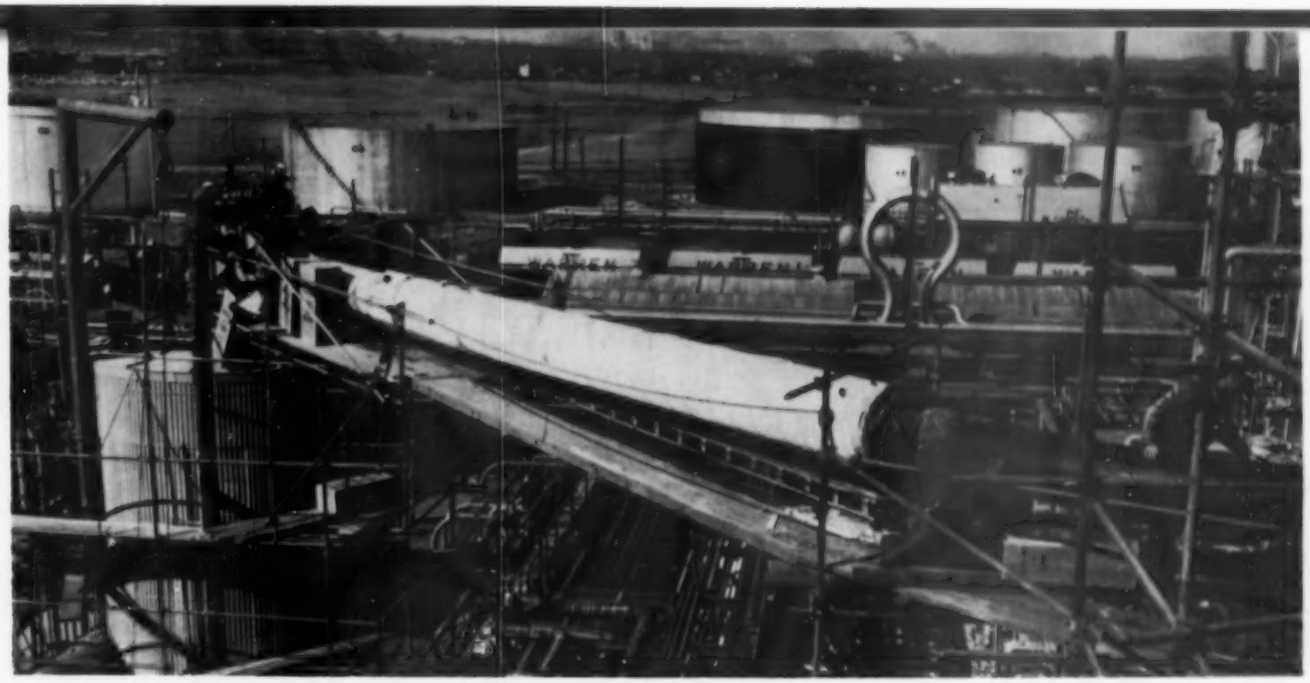
INSULATION of hot equipment and piping in a petroleum refinery is undertaken for several purposes: it may be for control of operating temperatures, the conservation of fuel, the protection of personnel, fire prevention or the protection of equipment in the event of fire. Frequently, the objective is a combination of two or more of these.

Insulation at the new airlift TCC unit of Socony-Vacuum Oil Co., Inc., in East St. Louis, Ill., is an example of how the type, thickness and methods of application are determined to accomplish the desired objectives when the insulation materials being used are based on 85 percent magnesia and diatomaceous silica products. Material types and application methods are chosen after economic studies based on current cost for each project.

Because fuel for refinery operations is usually readily available in quantity at low cost, fuel economy alone is not always the major consideration in insulation requirements. On the other hand, the trend of the refining industry to use "everything in the pig but the squeal" dictates against squandering by-products in heat generation operations.

When the most economical thickness of insulation is the principal consideration, it is determined by calculating that thickness at which the sum of the annual cost of heat loss and the amortized annual cost of applied insulation is lowest. Operating temperature control is governed by the thickness of insulation required to maintain a given temperature range of the materials in the process. Personnel protection is accomplished by employing insulation thicknesses which reduce the outer temperature of the insulation below the danger point.

In East St. Louis, Socony-Vacuum used



*Partially insulated tar separator overhead line. Right, mechanic prepares pipe surface prior to applying additional insulation.*

*Asbestos cement finish is applied to 85 percent magnesia block insulation on life pipe; exposed insulation shows retaining straps.*

*Block insulation on underside of combustion air inlet to kiln is secured with lacing wires affixed to anchors on duct surface. Finish will be applied after other sides of rectangular duct are insulated.*

a tested formula for achieving fuel economy and operating temperature control. For example, on all towers, vessels and exchangers operating at temperatures from 150°F through 600°F, insulation was specified to hold the heat loss to less than 75 Btu per sq. ft. per hr. at an assumed still air temperature of 50°F.

Table I gives the insulation thickness used on equipment in this and other temperature ranges. As examples of how this maximum permissible heat loss was maintained, equipment operating at 550°F has 3½-inch thick 85 percent magnesia insulation. At the stipulated 50°F still air temperature, this would reduce heat loss to approximately 60 Btu per sq. ft. per hr. On equipment with 200°F temperature, 1½-inch thick magnesia insulation holds heat loss to about 35 Btu per sq. ft. per hr. In both examples and with all equipment in this temperature range, the heat loss control meant that essential operating temperatures would be maintained while the fuel consumption would be held within reasonable limits.

Similar calculations were employed to determine insulation thicknesses at higher operating temperatures where the same objectives applied.

At the opposite extreme were instances in which personnel protection was the primary consideration. In general, an outer insulation surface temperature of 175°F is considered safe in the event of personnel contact. Table II gives the thicknesses of insulation employed where this was the only insulating objective. To take a single example from the table, equipment operating at 550°F with a still air temperature of 100°F and insulated with 1½-inch thick 85 percent magnesia would have a calculated insulation outer surface temperature of approximately 160°F.

While equipment and piping seldom are insulated for fire prevention or protection purposes alone, the Socony-Vacuum plant employed one technique offering special protection where equipment expansion might cause openings in insulation joints. Double layer insulation with staggered joints not only prevented a direct path for heat to combustible materials, but also prevented flammable liquids from contacting hot surfaces. In the cases of equipment operating at temperatures exceeding 600°F, the insulation consisted of an inner layer of diatomaceous silica insulation and an outer layer of 85 percent magnesia.

Pipe insulation thickness schedules are given in Table III.

In addition to the types and thicknesses of insulation, the methods of application

**TABLE III**
**INSULATION THICKNESSES (NOMINAL INCHES) FOR HOT PIPING**
**PIPE SIZES—INCHES**

| TEMP. F | ½ | ¾ | 1 | 1½ | 2 | 2½ | 3 | 4 | 6 | 8 | 10 | 12 | 14 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 85% Mag. 201–250 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1½ | 1½ | 1½ | — | — |
| Dia. Sil. | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 85% Mag. 251–400 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1½ | 1½ | 1½ | 2 | 2 | 2 | 2 |
| Dia. Sil. | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 85% Mag. 401–550 | 1½ | 1½ | 1½ | 1½ | 1½ | 1½ | 1½ | 2 | 2 | 2 | 2½ | 2½ | 2½ | 2½ |
| Dia. Sil. | — | — | — | — | — | — | — | — | — | — | — | — | — | — |
| 85% Mag. 551–800 | — | — | — | — | — | 1½ | 1½ | 1½ | 2 | 2 | 2 | 2 | 2 | 2 |
| Dia. Sil. | 2 | 2 | 2 | 2 | 2 | 1½ | 1½ | 1 | 1½ | 1½ | 1½ | 1½ | 1½ | 1½ |
| 85% Mag. 801–1000 | — | — | — | — | — | 2 | 2 | 2 | 2½ | 2½ | 2 | 2 | 2 | 2 |
| Dia. Sil. | 2 | 2 | 2 | 2 | 2 | 1½ | 1½ | 1½ | 1½ | 1½ | 1½ | 1½ | 1½ | 1½ |
| 85% Mag. 1001–1200 | — | — | — | — | — | — | 1½ | 1½ | 2 | 2 | 2 | 2 | 2 | 2 |
| Dia. Sil. | — | — | — | — | — | — | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

85% Mag.—85% Magnesia
Dia. Sil.—Diatomaceous silica

**TABLE I**
**INSULATION THICKNESS (NOMINAL INCHES) ON VESSELS, TOWERS AND EXCHANGERS**

| Temperature Range | 85% Magnesia | Diatomaceous Silica | Total |
|---|---|---|---|
| * 150 - 300 | 1 ½ | ... | 1 ½ |
| * 300 - 400 | 2 | ... | 2 |
| * 400 - 500 | 2 ½ | ... | 2 ½ |
| * 500 - 600 | 3 ½ | ... | 3 ½ |
| 600 - 750 | 2 ½ | 1 ½ | 4 |
| 750 - 900 | 2 | 2 | 4 |
| 900 -1000 | 2 | 2 ½ | 4 ½ |
| 1000 -1200 | 1 ½ | 3 ½ | 5 |

* Thickness based upon a maximum heat loss of 75 Btu per sq. ft. per hr. at 50°F still air temperature.

**TABLE II**
**INSULATION THICKNESS (NOMINAL INCHES) FOR PERSONNEL PROTECTION ONLY**
**(Vessels, Towers, Exchangers*)**

| Temperature Range | 85% Magnesia | Diatomaceous Silica | Total |
|---|---|---|---|
| 150 - 300 | 1 | ... | 1 |
| 300 - 400 | 1 | ... | 1 |
| 400 - 500 | 1 ½ | ... | 1 ½ |
| 500 - 600 | 1 ½ | ... | 1 ½ |
| 600 - 750 | ... | 2 | 2 |
| 750 - 900 | ... | 2 ½ | 2 ½ |
| 900 -1000 | 1 ½ | 1 ½ | 3 |
| 1000 -1200 | 1 ½ | 2 ½ | 4 |

* On pipe lines having temperatures from 200° to 600°F, 85 percent magnesia insulation is used for personnel protection in thicknesses of nominal 1 and 1 ½ in. depending on pipe size and temperature.
Personnel protection on pipe lines from 600° to 800°F is provided by diatomaceous silica insulation of nominal 1 ½ to 2-in. thicknesses.

and finishing are equally important to the accomplishment of objectives and the control of insulation maintenance.

Block insulation on vertical towers and vessels is supported by metal rings welded circumferentially to the shells on approximately 12-foot centers. Blocks are secured firmly in place by ¾-inch 18-8 straps laced through holes punched in the metal retaining rings for that purpose. Bands are spaced on approximately 9-inch centers. The inner layer of combination insulation is banded on approximately 18-inch centers.

Expansion joints to accommodate shell movement are provided by leaving a narrow space between the tops of blocks and the under surface of each support ring. This space was then hand-packed with loose insulating material retained by a flat metal strip 6 inches wide.

Lugs welded to the top and bottom heads of vertical vessels provide anchor points for bindings to secure block insulation to these surfaces.

Angle irons welded lengthwise to the shells of horizontal vessels and exchangers support insulation on this class of equipment. Blocks are banded to the shells in the same manner as on vertical equipment, and similar expansion joints are provided.

The insulation on vertical towers and vessels over 36 inches in diameter is jacketed with corrugated copper-bearing galvanized iron sheets. Flat sheets of the same composition are applied over the insulation on vertical vessels under 36 inches in diameter. Insulation on horizontal tanks and vessels is finished with a double layer of asphaltic plastic weather-proofing.

Piping operating at temperatures between 200° and 550°F is insulated with single layers of sectional magnesia. Small pipe lines (½-inch through 2-inches) operating between 550° and 1,000°F are insulated with single layers of diatomaceous silica. Combination insulation is applied to larger pipe lines (2½-inches through 16-inches) operating in the range 550°-1,200°F. Sections are held in place by copper-clad wire loops on pipes up to 2½ inches. On the larger lines, ½-inch wide metal bands are used instead of wire.

Flanges, control valves, line valves, valve bonnets and fittings subject to periodic removal for inspection and maintenance are not insulated. Pipe line insulation adjacent to these is tapered down so that it will not be damaged when nuts and stud bolts are removed. Permanent flanges and fittings are covered with block insulation of the same material as the pipe line in which they are installed. Blocks are mitered to fit snugly and are wired in place. Irregularly shaped fittings are insulated with plastic material to the full thickness of adjacent pipe insulation.

On outdoor piping, insulation is protected from the weather by either metal jacketing or asphalt-saturated asbestos roofing felt. Metal jackets are used wherever there is danger of mechanical damage to the insulation, such as in areas of high traffic. Indoors, pipe lines are jacketed with 8-ounce sewed canvas.

*first quarter*

# WORLD CRUDE PRODUCTION

## *rises sharply*

WORLD PRODUCTION of crude oil increased 630,000 barrels daily in the first quarter, according to estimates gathered by this publication. Most of the increases were centered in the United States, Venezuela and the Middle East.

North American production topped seven million barrels daily in the first quarter, a new peak. An increase of nearly 400,000 b/d in the United States coincided with an increase of about 10 percent in Canada made possible by increased deliveries to General Petroleum Corporation's new refinery in the Pacific Northwest.

Latin American crude production in the first quarter averaged 2,452,700 b/d compared with 2,328,900 b/d in the final quarter of 1954 and 2,218,700 b/d for all of last year. Much of the 244,000 b/d increase in South America was seasonal, principal growth in offtake being from heavy oil areas to supply winter fuel requirements.

The tendency of United States refiners to upgrade products and to reduce the production of residual fuels has had a marked effect on the production of crude in Venezuela during the past several months. Demand for heavy fuels has been excellent during the past winter as a result of colder weather and improved industrial activity. The weather was about six percent colder than a year previously.

In order to meet improved demand, California refiners have shipped some heavy oils through the Panama Canal to the East Coast and inshipments from Venezuela have set a new record. Despite the large increases in imports, there has been no expansion of residual fuel inventories.

The effect on Venezuelan production was to permit an increase of nearly 200,000 b/d. From a low of 1,840,400 b/d in the third quarter, Venezuelan output increased to 2,003,500 b/d in the final quarter of 1954 and is estimated at 2,120,000 b/d in the first three months of 1955. This estimate is based on incomplete March figures. January official figures were 2,111,400 b/d and February output was about 2,150,000 b/d.

Production in Argentina has been increasing in recent months, largely as a result of further drilling in the Madrejones field north of Campo Duran near the Bolivian border. Madrejones wells are completed at about 13,000 feet with initial output of well over 1,500 b/d. Six wells are producing and an additional half dozen being drilled. National output is about 12,000 b/d more than a few months ago, averaging about 92,000 b/d.

First discovery in the Sechura desert in Peru since intensive exploration was begun is a 500-barrel well a half mile south of the Portachuelo field. Several companies have abandoned the desert and are concentrating on the Montana.

European crude production as a whole continues to expand. In Italy, Petrosud S.A. (Montecatini-Gulf) has made an important discovery on the Adriatic which tested 2,000 b/d of 34 gravity crude from Tertiary lime topped at 2,550 feet.

Commercial production was begun in January by Gulf's American International Fuel & Petroleum Co. from three wells drilled last year in the Ragusa field, Sicily. The 20 gravity heavy oil is being shipped to the Rasiom refinery at Augusta for processing.

The Parentis field in France now is producing at an increased rate with the result that continental French production is nearly three times as large as a year ago. One well in this field is reported to be producing 3,500 b/d.

Western Germany's crude output continues its steady upward climb and now has exceeded 60,000 b/d.

Opinion in the West regarding the current level of production in Romania is undergoing an upward revision. In a recent book, *The Romanian Oil Industry*, Constantin N. Jordan, former secretary-general of Steaua Romana, has estimated that production rose from 83,000 b/d in 1950 to 102,000 b/d in 1951 and 131,000 b/d in 1952.

Petroleum Press Service of London has estimated 1952 production at an even higher level—172,000 b/d. The same source places 1953 output at 180,000 b/d and 1954 at 200,000 b/d. Support for the estimate is seen in the report that Russia and Romania shipped about 92,000 b/d of crude and products in 1954 to countries outside the Russian orbit. This compares with about 40,000 b/d in 1953.

Observers in the United States now are inclined to agree that Romanian output currently is about 200,000 b/d, a much higher estimate than heretofore. It is indicated that Romania has found new fields and is exploiting previously known reserves as rapidly as possible, as is also the case in the Russian zone of Austria.

In 1954 it is believed that Russian crude output was in line with government announcements at about 1,145,000 b/d.

*(Continued on page 92)*

**WORLD CRUDE OIL PRODUCTION**

(Thousands of Barrels Daily)

| | 1955 First Quarter | 1954 Fourth Quarter | 1954 |
|---|---|---|---|
| **NORTH AMERICA** | | | |
| United States | 6,612.0 | 6,237.0 | 6,345.9 |
| Canada | 312.0 | 281.0 | 261.1 |
| Mexico | 235.0 | 235.0 | 228.4 |
| Total | 7,159.0 | 6,753.0 | 6,835.4 |
| **SOUTH AMERICA** | | | |
| Venezuela | 2,120.0 | 2,003.5 | 1,895.3 |
| Colombia | 106.0 | 103.9 | 109.5 |
| Argentina | 92.0 | 85.5 | 81.0 |
| Trinidad | 65.0 | 67.0 | 66.0 |
| Peru | 47.0 | 47.0 | 46.9 |
| Ecuador | 8.5 | 8.5 | 8.5 |
| Chile | 6.0 | 4.1 | 4.1 |
| Brazil | 2.5 | 4.0 | 2.5 |
| Bolivia | 5.2 | 5.1 | 4.8 |
| Cuba | 0.5 | 0.3 | 0.1 |
| Total | 2,452.7 | 2,328.9 | 2,218.7 |
| **WESTERN HEMISPHERE** | 9,611.7 | 9,081.9 | 9,054.1 |
| **EUROPE & AFRICA** | | | |
| Austria | 58.0 | 62.0 | 61.5 |
| Germany | 62.0 | 55.0 | 51.7 |
| Netherlands | 18.9 | 18.2 | 18.0 |
| Hungary | 14.0 | 14.0 | 14.0 |
| France | 18.0 | 14.5 | 10.0 |
| Yugoslavia | 3.0 | 3.0 | 3.0 |
| French Morocco | 2.5 | 2.5 | 2.4 |
| Italy | 2.8 | 2.1 | 2.0 |
| Algeria | 1.5 | 1.8 | 1.7 |
| United Kingdom | 1.2 | 1.2 | 1.2 |
| Total (Exc. USSR & Sat.) | 181.9 | 174.3 | 165.5 |
| USSR | 1,215.0 | 1,190.0 | 1,145.0 |
| Romania | 200.0 | 200.0 | 200.0 |
| Poland | 4.0 | 4.0 | 4.0 |
| Albania | 3.0 | 3.0 | 3.0 |
| Czechoslovakia | 2.5 | 2.5 | 2.5 |
| Total | 1,424.5 | 1,399.5 | 1,354.5 |
| Total Europe | 1,606.4 | 1,573.8 | 1,520.0 |
| **NEAR & MIDDLE EAST** | | | |
| Kuwait | 1,010.0 | 1,038.1 | 960.0 |
| Saudi Arabia | 944.2 | 928.1 | 952.8 |
| Iraq | 640.0 | 650.6 | 627.0 |
| Qatar | 101.0 | 104.5 | 99.4 |
| Iran | 230.0 | 152.0 | 111.0 |
| Egypt | 38.0 | 38.0 | 37.7 |
| Bahrain | 30.1 | 30.1 | 30.1 |
| Neutral Zone | 30.0 | 20.0 | 15.6 |
| Turkey | 1.8 | 1.8 | 1.1 |
| Total | 3,025.1 | 2,963.2 | 2,834.7 |
| **FAR EAST & OCEANIA** | | | |
| Indonesia | 242.2 | 233.0 | 225.2 |
| British Borneo | 95.0 | 99.0 | 99.0 |
| Japan | 5.9 | 5.9 | 5.9 |
| India | 6.1 | 6.1 | 6.1 |
| New Guinea | 13.0 | 13.0 | 11.0 |
| Pakistan | 6.0 | 6.0 | 5.3 |
| Burma | 4.5 | 4.5 | 3.8 |
| China | 2.5 | 2.5 | 2.4 |
| Total | 375.2 | 370.0 | 358.7 |
| **EASTERN HEMISPHERE** | 5,006.7 | 4,907.0 | 4,712.7 |
| **WORLD TOTAL** | 14,618.4 | 13,988.9 | 13,766.8 |

# STYLE and **POWER** feature 1955 cars

NEW STYLING and another sharp increase in horsepower ratings feature the bitter competition among passenger car manufacturers of the United States for a bigger share of the 1955 market. An increase of 300,000 units to 5,800,000 cars is forecast and every maker is eager for orders.

In the horsepower race Chrysler leads the field by offering the industry's "highest powered" car—the Chrysler 300. This car uses a FirePower V-8 engine that has been modified to develop 300 hp. A 250 hp version of this engine is used in the Imperial and the Chrysler New Yorker Deluxe. In 1954 both the Imperial and the New Yorker Deluxe used a FirePower V-8 engine that put out 235 hp. Other cars in the high horsepower brackets are the Packard Caribbean with a 275 hp engine and the Cadillac El Dorado, which has a 270 hp powerplant. The average horsepower for all cars for 1955 is about 178, compared with 152 in 1954. Torque is also up, the average being 260 pounds-feet, an increase of 18 pounds-feet over 1954. This, to a large extent, accounts for the sparkling performance of the new cars at low speeds.

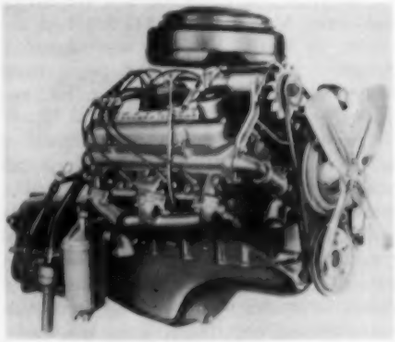
With five more manufacturers succumbing to the popular V-8 engine, the in-line engine is now just about extinct. Chevrolet and Plymouth have finally followed the example set by Ford over 20 years ago. True, both the Chevrolet and the Plymouth, and the Ford too, offer in-line engines as optional on certain models, but the in-line engine is only standard on the Nash Rambler, the Willys and the Studebaker Champion. The general adoption of the V-8 has been the result of the need for more compact and rigid powerplants to develop the greater horsepower in the confined space under the modern sloping hoods. Some indication of the success in this direction can be obtained from the following comparison of horsepower per cubic inch for 1954 in-line engines with the new 1955 V-8's:

| MAKE | 1954 IN-LINE | 1955 V-8 |
|---|---|---|
| Chevrolet | .531 | .679 |
| Plymouth | .459 | .681 |
| Pontiac | .485 | .627 |
| DeSoto | .463 | .636 |

The foregoing point is further illustrated by the fact that the new Chevrolet V-8 developing 162 hp weighs 531 pounds compared with about 560 pounds for the 125 hp, six cylinder, in-line engine it replaces.

The Chevrolet engine, like the V-8's of Plymouth and Pontiac, is the result of several years of research and development. It is only 22 inches long, yet it has a 265 cubic inch displacement and in the standard production version develops 162 hp at 4,400 rpm. Compression ratio is 8:1.

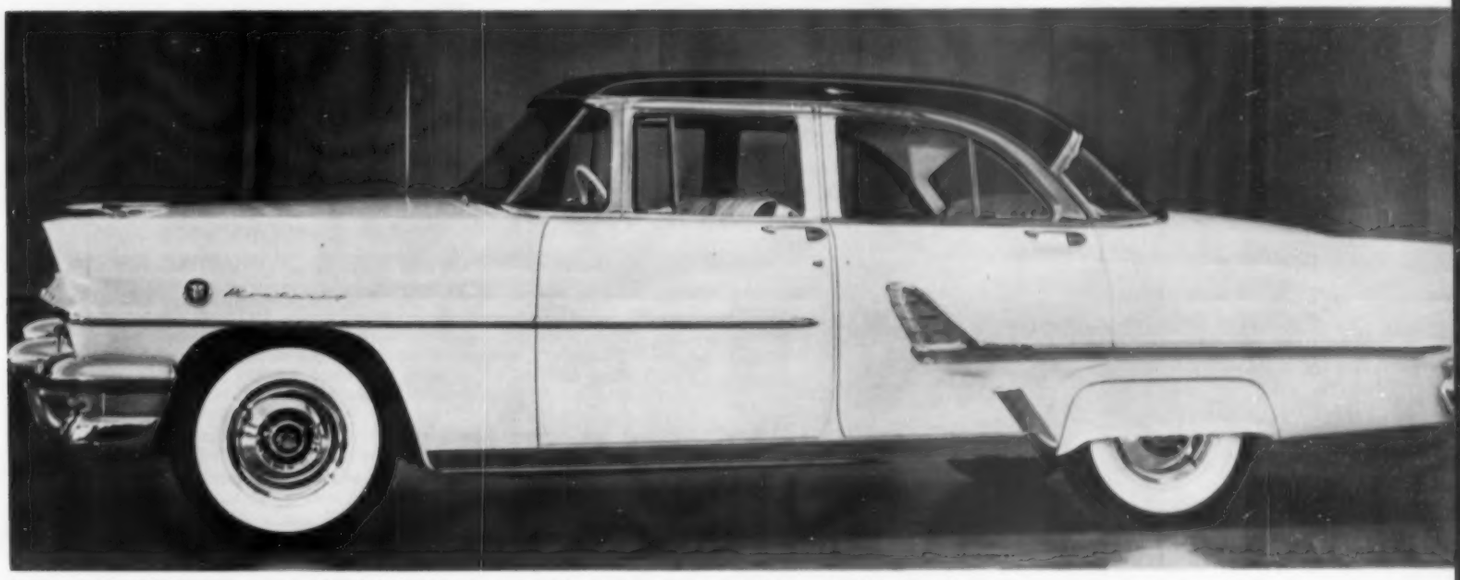
*Pontiac's new 180 hp Strato-Streak V8 engine has a compression ratio of 8:1 and a displacement of 287 cubic inches.*



*The original V8 Chevrolet, left, was built between 1917 and 1919, then discarded in favor of the six. Chevrolet's 1955 V8, right, develops 162 horsepower with optional "power package" of 180 horsepower available.*

A special version, with four-barrel carburetor and dual exhausts, has a rating of 180 hp. In both the Chevrolet and Pontiac engines a new valve operating mechanism is used that does not employ a rocker shaft. As a result, the effect one rocker arm may have on another is eliminated. The combustion chamber in the Chevrolet engine is described as being of "high turbulence, wedge-type design for combustion control and combustion smoothness." Under normal conditions, the octane number for Powerglide-equipped cars is said to be between 85 and 90 with 5,000 to 25,000 miles of operation. Under the same conditions, but with conventional transmission, the octane requirement is 88 to 93.

The new Plymouth V-8 bears some relationship to the Red Ram used on the Dodge. It comes in two displacements, a 241 cubic inch and a 259 cubic inch ver-



*Mercury for 1955 features a one-shot lubrication system with only two fittings to be serviced by hand.*

sion. The former is the 157 hp Hy-Fire engine while the latter is a Hy-Fire that puts out 167 hp. Plymouth soups up the larger version with a four-barrel carburetor to give the 177 hp engine used in the Belvedere chassis. The compression ratio is, according to 1955 standards, on the low side, being 7.6 to 1.

Pontiac's new V-8, the Strato-Streak, also comes in two packages, 173 hp and 180. Displacement is 287 cubic inches and the compression ratio is 8:1. Torque is 260 pounds-feet (average for both engines). Particular attention has been paid in designing the combustion chamber and in selecting the compression ratio so that knocking will be at a minimum with available fuels in all parts of the country.

Ford has also revamped its V-8 and offers it in two versions, the standard 162 hp Y-block V-8 and the 182 hp Y-block Special V-8. Both have 272 cubic inches of displacement, but the standard version has a 7.6 to 1 compression ratio compared with a compression ratio of 8.5 to 1 on the Special. The latter engine, which is standard on all Fordomatic-equipped Fairlane and Station Wagon models, also has a four-barrel carburetor. Ford has raised the displacement of its engines by 33 cubic inches over 1954 and the compression ratio on the standard model has been increased from 7.2 to 1. Because of improvements in combustion chamber design and valve cooling, plus Turbo-Action spark plugs (i.e. plugs with greater clearance between the plug shell and the insulator tip), Ford claims that the octane requirements of the standard engine have not been increased. Ford is also offering a full-flow oil filter on all engines, an important innovation in the low-price field. Topping the Ford line is the engine used in the Thunderbird, Ford's sports car designed to compete with the Chevrolet Corvette. The Thunderbird engine is an overhead valve, Y-block V-8 similar to the other Ford V-8's, but it is rated at 198 hp equipped with Fordomatic Drive and 190 with the standard transmission.

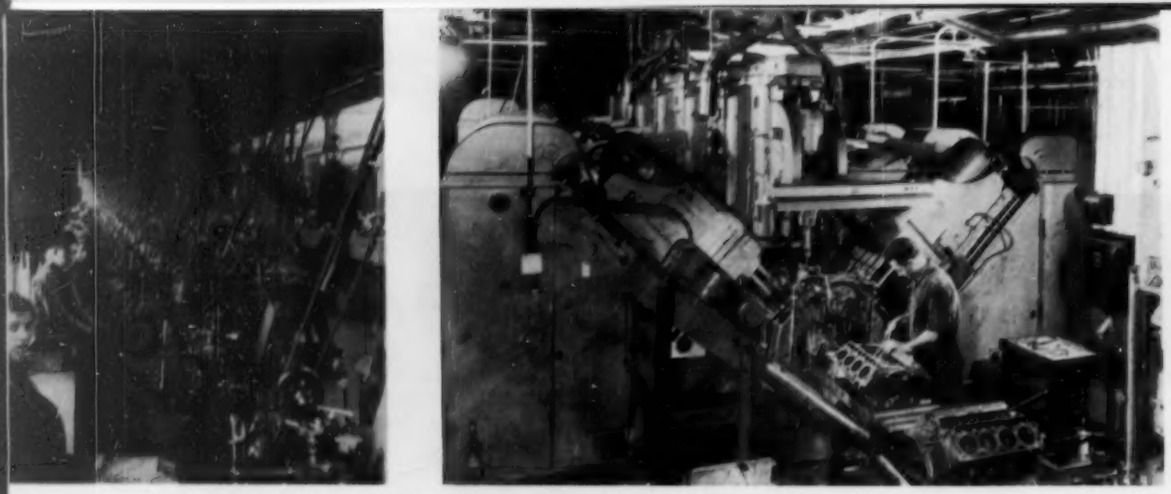
The Buick V-8, which first made its appearance in 1953, has been given several refinements in 1955 that increase the horsepower and result in greater efficiency and economy. In the past six years Buick has made great strides in improving gas mileage. For example, according to the chief engineer of Buick, it was possible to get only 16.6 miles per gallon with a 1949 Buick Roadmaster when driving at a constant speed of 30 miles an hour. In 1955 this figure has gone up to 21.4 miles per gallon—an increase of 4.8 miles. At 50 miles an hour the 1949 model gets 14.4 miles per gallon; the new model gets 18.9 miles a gallon. Compression ratio in the 1955 Buick engine is 9 to 1, about the highest in the industry.

Packard, which began making V-8's as long ago as 1915, has been reluctant to give up its time-tested L-head straight eights. There are those who remember, however, the V-12 of the Thirties. The general trend has caught up with Packard nevertheless, and for 1955 its models are being powered by V-8's of 225 hp, 245 hp, 260 hp and in the deluxe Caribbean a 275 hp engine makes its appearance. Basically Packard is turning out two engines, one having a displacement of 320 cubic inches and the other 352. This is achieved by using the same stroke, 3½ inches, but two bores, one 3 13/16 inches and the other four inches. Packard engines have overhead valves, parabolic combustion chambers, and a four-barrel carburetor. The 225 hp engines are used on the Clipper Super and Clipper Deluxe models while the 245 hp engine goes in the Clipper Custom. The latter engine is one of the 352 cubic inch displacement series. This same displacement series, but rated at 260 hp, goes in the 400 and Patrician models.

While confirmation has not been forthcoming, it is generally understood that the smaller displacement Packard engine, with perhaps some modifications, is being made available to Hudson and Nash. Nash is using it in the 1955 Ambassadors as optional, as is Hudson in the Hornet. Both Nash and Hudson are offering a range of L-head sizes in all models.

Several changes have been made in the Lincoln engine for 1955, among them a larger intake manifold, improved four-barrel carburetion, and a redesigned "open" wedge turbulent type combustion chamber designed to improve exhaust valve cooling and to reduce the octane requirement of the engine. Compression ratio has been upped to 8.5 to 1. These changes have increased the output to 225 hp compared with 205 on last year's models. In comparing the 1955 Lincoln engine with others, it is seen that it has lost the horsepower race to the higher priced Buicks, the Chrysler New Yorker, the Imperial, the Packard and the Cadillac.

Kaiser, it appears, is concentrating on the Willys and the Jeep line. The Kaiser itself will be produced only in limited quantities in order to use up the fabricated bodies that are on hand at Willow Run. It is being offered only in the supercharged Manhattan four-door sedan. The



*Views of Cadillac machining operations in 1902 (left) and 1955 (right).*

Willys is being offered in two models, the Bermuda hardtop and the Custom four-door sedan. Only one engine is being used by Willys, a Willys version of the Kaiser "supersonic" L-head six rated at 115 hp. The former F-head engine is reserved for station wagons and the commercial vehicles that Kaiser is turning out.

In the transmission field, changes have been made in some instances to handle the increased horsepower of the 1955 engines. Lincoln, for example, has come out with an entirely new Turbo-Drive, a combination of an hydraulic torque converter and planetary gearing. Extra performance at take-off or starting is provided by permitting a low gear start at wide open throttle through a specially designed throttle kickdown while the selector is in drive position. From a standing start in drive range the new Lincoln with Turbo-Drive will move off under wide open throttle in low gear, with an automatic upshift from low to intermediate gear occurring at about 35 miles per hour. Continued acceleration with wide open throttle will result in automatic upshift from intermediate to high gear at about 75 miles per hour. It is also possible to obtain low gear kickdown from intermediate or third gear by depressing the accelerator into the kickdown position if the car speed is below approximately 20 miles an hour. In addition to the normal type of drive range with its one shift, and the kickdown low gear for maximum performance in drive range, the normal low gear is available for downhill braking, for extra-heavy pulls, and for rocking in mud or snow.

The most progressive step in the automatic transmission field comes from Buick which has made an important modification to its Dynaflow. To do this it has borrowed a trick from the aviation industry where engineers long ago developed the variable pitch propeller to ensure maximum efficiency under all conditions. Buick's Dynaflow torque converter of previous years can be likened to the fixed pitch propeller on an airplane where the angle of the blade is set to give a compromise between maximum efficiency at take-off and maximum efficiency at cruise. In the case of Dynaflow, it was the angle of the blades on the stator that was fixed. As a result, acceleration was penalized and gas mileage was reduced because the transfer of power through the fluid was not at maximum efficiency under all conditions of load and throttle. This year Buick has come out with variable pitch blades on the stator and the device consequently works at maximum efficiency under all conditions. It is also completely silent and smooth, with no jarring entry into another gear after a momentary pause or "bump."

To Packard goes the credit for a startling new development in automobile designing, for this year it has come out with an entirely new suspension. Gone are the coil and leaf springs that have been the favorite form of suspension in U. S. cars. In their place Packard has put torsion bars, one on each side, to replace the coil spring in front and the leaf spring in the rear. These bars absorb the road shocks by twisting and do away with the bottoming and diving that the driver experiences with conventional suspensions when the car is accelerated or braked. These bars are nine feet long and about one inch in diameter with lever bars at each end so arranged that they induce twist in the torsion bar when a force is applied to the wheels. As a result, the twist is absorbed by the bars and is not transmitted to the frame.

A plus feature of this new suspension is the automatic leveler that always keeps the body at a predetermined height above the road no matter what load the car is carrying. This means that road clearance is not reduced by heavy loads and the headlights are always at the right angle to the road. Heart of this device is a geared down electric motor that is actuated by two leveling bars which in actuality are two auxiliary torsion bars fixed at one end to the main torque arms. To prevent the leveler's working in response to road jars, a six-second time delay switch controls the motor which has a sensing device to tell it the attitude of the car with respect to the road. This form of suspension is expected to be found on other cars before long, for it has been used, in a simpler form, on some European models for some time.

Like the V-8 engine, the wrap-around windshield has made a clean sweep of the field. In fact, so powerful is the sales appeal of the new windshield that Studebaker, which came out last fall with its 1955 models equipped with the ordinary windshield, has been forced to come out with new models incorporating this fashionable feature. This means Studebaker has 1955 and "1955½" models—a most unusual position for a manufacturer to be in and undoubtedly an expensive one.

An accessory that has been revived after many years is the one-shot lubrication system that is optional equipment on Lincoln and Mercury models. When this equipment is installed, only two universal joint fittings remain to be lubricated by hand. The vacuum power from the engine provides the force to move the lubricant from the reservoir to the fittings. This reservoir holds enough lubricant for 225 applications.

Later this year Ford plans to bring out the Continental that has been absent from the American scene since the war. The increasing popularity of the Cadillac would indicate, Ford feels, that there is a market for a fine car produced in limited quantities, a car that will have the exclusiveness that belongs only to European imports like the Rolls and the Bentley. Initial production of the Continental will be between 2,500 and 5,000 cars a year, compared with the 150,000 that Cadillac is aiming for. The cost will be high, about $10,000, but Ford feels there is a potential market for a limited number of cars in this price range. It will be an interesting experiment, for it will be the first American car in almost 20 years not to be a product of mass production techniques.

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## GEWERKSCHAFT ERDÖL-RAFFINERIE EMSLAND, GERMANY

The Houdriflow catalytic cracker of the Gewerkschaft Erdöl-Raffinerie Emsland, at Lingen, Germany, is the principal unit in a completely new refinery. This 17,500 BPSD cracker went on stream in the Fall of 1953.

The Emsland Houdriflow cracks straight run and coker gas oils and, in addition, desulphurizes the straight run and coker gasoline simultaneously. The refinery is currently processing a mixture of Georgsdorf and Emlichheim crudes. A unique processing scheme is employed at this refinery. No crude distillation unit exists; the Houdriflow feed stock comprises all flashed straight run materials from the crude as well as total coker effluent—gas, gasoline and gas oil. This integrated arrangement eliminates intermediate storage, thereby reducing operating and equipment costs.

A new brochure describing the Houdriflow process is available on request. Houdry Process Corporation, 1528 Walnut Street, Philadelphia 2, Pa. International Representative: World Commerce Corporation, S. A.

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# NEW LEBANON REFINERY ON STREAM

*6,000-barrel crude unit at Medreco refinery, Sidon, Lebanon.*

PRESIDENT Camille Chaumon of Lebanon formally opened on February 1 the new $8 million Sidon refinery of the Mediterranean Refining Co. The company is jointly owned by California Texas Oil Co. Ltd. and Socony-Vacuum Overseas Supply Co.

Capacity at the time operations began was 6,000 barrels daily. This is to be increased to 9,000 b/d, the additional facilities being planned for operation in 1956.

The present refinery consists of an atmospheric crude distillation unit and a Platformer for catalytic reforming of naphthas to higher octane levels. Auxiliary units include a cafeteria, laboratories, power plant, machine shops, fire protection and first aid facilities. Storage capacity for products is 163,000 barrels and for process oils 60,000 barrels.

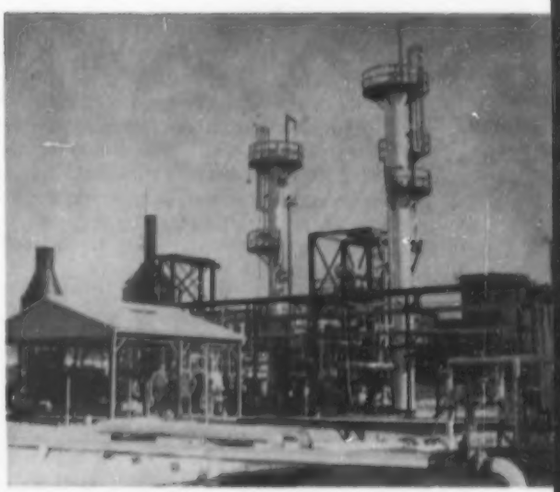
Crude for the plant is delivered from the adjacent western terminus of the Trans Arabian pipe line which carries Saudi Arabian crude from Persian Gulf fields to the Mediterranean seaboard for transshipment to European refineries. Decision to build the refinery goes back to the time when plans first were made to lay the pipe line. The Lebanese government then asked the companies to build such a refinery and an agreement was ratified by the Lebanese parliament on November 26, 1945.

Completion of the plant will eliminate the necessity for importing large volumes of refined products into Lebanon. The one other refinery at Tripoli operated by Iraq Petroleum Co. has been unable to supply all local demands with the result that about a third of domestic kerosine demand, 40 percent of gasoline and 60 percent of gas oil requirements have been imported. Local prices will be lower as imports are reduced or eliminated.

Lebanon depends largely on road vehicles for transportation of goods and passengers, and like other areas in the Middle East has been expanding its consumption of oil products at a rapid rate since World War II. In 1953 the U. S. Bureau of Mines reported an increase of 13.9 percent in consumption of principal products in Lebanon and Syria. Total demand was 5,727,000 barrels, of which 1,666,000 barrels was motor fuel; 653,000 barrels kerosine; 1,545,000 barrels distillate fuel; 1,798,000 barrels residual fuel; and 65,500 barrels lubricating oil. Estimates for the year 1954 by this publication indicate that demand rose another 12.5 percent last year to over 6,400,000 barrels.

Late last year a controversy over proper domestic prices arose between the company and the government. During discussions work was halted on the refinery. Work was resumed late in December when an accord was reached on prices. The accord was said to implement an agreement dating back to 1952. Under terms of the agreement, the Lebanese government will make substantial savings in comparison with the cost of imported goods.

New construction work being undertaken involves erection of a second Platformer and an additional crude unit.



*Platformer for catalytic polymerization of naphthas.*

**TABLE IV**

**PILOT PLANT REXFORMING DATA MIDCONTINENT FEED STOCK**

| Inspection Data | Fresh Charge | Rerun Bottoms | Combined Feed | Stabilized Reactor Effluent | Low Octane Recycle | Debutanized Rexformate |
|---|---|---|---|---|---|---|
| Gravity, °A.P.I. | 52.3 | 29.5 | 56.1 | 52.4 | 63.4 | 47.0 |
| F-1 Clear Octane | 33.0 | ... | ... | 76.3 | 41.0 | 97.2 |
| Aromatics, Vol. % | 9 | ... | ... | 37.5 | 8.5 | 53.5 |
| 100 Ml. Distillation I.B.P., °F. | 242 | 417 | 168 | 133 | 114 | 93 |
| 5% | 259 | 431 | 227 | 172 | 148 | 109 |
| 10 | 264 | 436 | 241 | 194 | 165 | 121 |
| 30 | 292 | ... | 271 | 245 | 225 | 173 |
| 50 | 316 | ... | 298 | 280 | 266 | 262 |
| 70 | 346 | ... | 332 | 313 | 300 | 309 |
| 90 | 374 | ... | 367 | 366 | 355 | 367 |
| 95 | 384 | ... | 376 | 387 | 378 | 393 |
| E.P., °F | 415 | ... | 395 | 424 | 420 | 424 |
| Quantities, Volumes Per 100 Volumes Net Feed | 101.4 | 1.4 | 144.6 | 125.1 | 44.6 | 80.5 |

## New Reforming Processes

*(Continued from page 31)*

through operation to the lower product octane number shown. In addition, space velocities utilized were higher on the basis of fresh feed than those ordinarily employed for once-through operations at considerably lower octane levels. The combination of the mild processing conditions and selective extraction made it possible to attain the high octane numbers with good yields.

Table III shows the results obtained in processing a highly paraffinic naphtha. Table IV shows the properties of the various streams obtained in Rexforming pilot plant operation. These data were obtained on a Midcontinent naphtha feed. A 41 octane number recycle stream was separated from the reactor effluent and recycled to commingle with fresh feed. Thus, the feed to the reactor was increased by about 40 percent. Since a higher space velocity was used in this case, less catalyst was actually required than for conventional once-through operations. The overall result is shown in the last column. In this particular operation, the low octane stream was completely recycled, but all or a portion of this material may be withdrawn as a net product for jet fuels.

The approximate investment and operating costs for Rexforming are given in Table V on the basis of charging 5,000 b/sd of full boiling Midcontinent straight-run gasoline and producing 101 F-1 clear Rexformate in a flow as outlined in Figure 1.

It is thus estimated that the Rexforming process for this type of operation costs about $300 per barrel to install and about 36c per barrel to operate, including the costs itemized in Table V.

Houdry Process announced that pilot plant runs of its new Iso-Plus process in three schematic variations produced approximately 86 percent, 87 percent and 91 percent conversion of naphtha feed stock to 100-octane clear gasoline.

With slight operational modification, it was said, one of the three Iso-Plus variations would yield more than 82 percent conversion to 108-octane (F-1 clear) gasoline for blending with refinery pool gasolines of lower anti-knock rating, resulting in higher overall pool octane number.

One Iso-Plus processing combination permits the combining of Houdriforming and aromatics extraction in either of two arrangements, and the other variation utilizes Houdriforming in combination with thermal reforming.

Experimental Iso-Plus processing of a naphtha containing 46 percent paraffins and having an end boiling point of 394°F indicated the yields of 10-pound Reid Vapor Pressure 100-octane F-1 clear gasoline shown in Table VI.

In the first and third Iso-Plus process variations, small amounts of outside butanes are required to supplement process-produced butanes blended to the reformate. In the Houdry pilot plant tests, aromatics were separated by the Arosorb adsorption process licensed by Sun Oil Co., although any equivalent process may be employed, it was stated.

Houdry researchers feel that the most attractive processing scheme involves thermal reforming of the paraffin concentrate removed from the Houdriformate. This scheme involves polymerization of recovered propene and butenes. Where thermal reforming capacity is available without new construction, this scheme becomes even more attractive.

The second most attractive processing scheme involves Houdriforming, separation of high octane and lighter fractions followed by catalytic reforming of the paraffin concentrate in a separate series of Houdriformer cases. An alternate method is to recycle the paraffin concentrate in the Houdriformer employed to process the virgin charge.

Highest investment cost is required in the processing scheme involving reforming the paraffin concentrate in separate catalyst cases, but yield of 100 octane product is substantially higher. This becomes more important as the value of charge rises.

Assuming a cost of eight cents per gallon for naphtha to be charged to the reformer, Houdry estimates product cost at 10.96 cents per gallon when thermal reforming is employed, 11.06 cents when the paraffin concentrate is separately Houdriformed, 11.44 cents when the concentrate is recycled, and 11.57 cents with once-through severe processing. These costs include 25 percent plant amortization, interest on investment and taxes.

Houdry Process announced that a commercial unit of its new Iso-Plus process is now being designed.

**TABLE V**

**ESTIMATED INVESTMENT & OPERATING COSTS FOR REXFORMING**

Basis: 5,000 b/sd Midcontinent full boiling straight run gasoline* producing 101 F-1 clear Rexformate (See Figure 1).

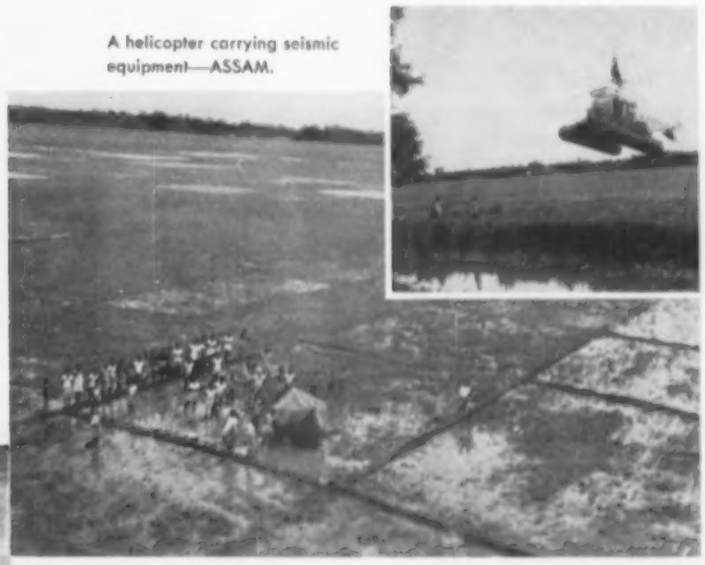
| | Total |
|---|---|
| Erected Cost | $1,600,000 |
| | c/bbl. Full Boiling Gasoline |
| **Operating Costs** | |
| Operating Labor @ $2.75 per hour | 4.0 |
| Laboratory | 1.0 |
| **Utilities** | |
| Fuel @ 15c/MM Btu | 7.3 |
| Power @ 0.8c/Kwh | 4.0 |
| Steam @ 30c/M lb. | 4.6 |
| Water @ 1c/M gal. | 1.4 |
| Catalyst | 6.9 |
| Solvent | 1.7 |
| Maintenance @ 3% of investment per year (Labor & Materials) | 2.8 |
| Insurance & Property Taxes @ 2% of investment per year | 1.9 |
| Total Operating Costs excluding Royalty, Depreciation, Administration and Overhead | 35.6 |

*4,300 b/sd fresh naphtha charge to reactor section.

**TABLE VI**

| Summary of Iso-Plus Process with Supplemental Process Variations | Naphtha Charge (Barrels per Day) | 100-Octane Clear Gasoline | Conversion (% of Chg.) |
|---|---|---|---|
| Houdriforming, depropanizing, depentanizing, separation of aromatics, Houdriforming of raffinate, depropanizing, butane blending | 6,600 | 5,993 | 90.8% |
| Houdriforming, depropanizing, debutanizing, depentanizing, recycling raffinate to Houdriformer, aromatics to blending | 6,600 | 5,751 | 87.1% |
| Houdriforming, depropanizing, depentanizing, thermal reforming, debutanizing, catalytic polymerization, blending | 6,600 | 5,671 | 85.9% |

# OIL
## MUST BE DISCOVERED



A helicopter carrying seismic equipment—ASSAM.

Erecting an Observer's Tent in a paddy field—ASSAM.

The traversing of flooded areas considerably slows up seismic operations. In ASSAM the numerous paddy fields in the Brahmaputra River valley render the use of land vehicles and boats impossible.

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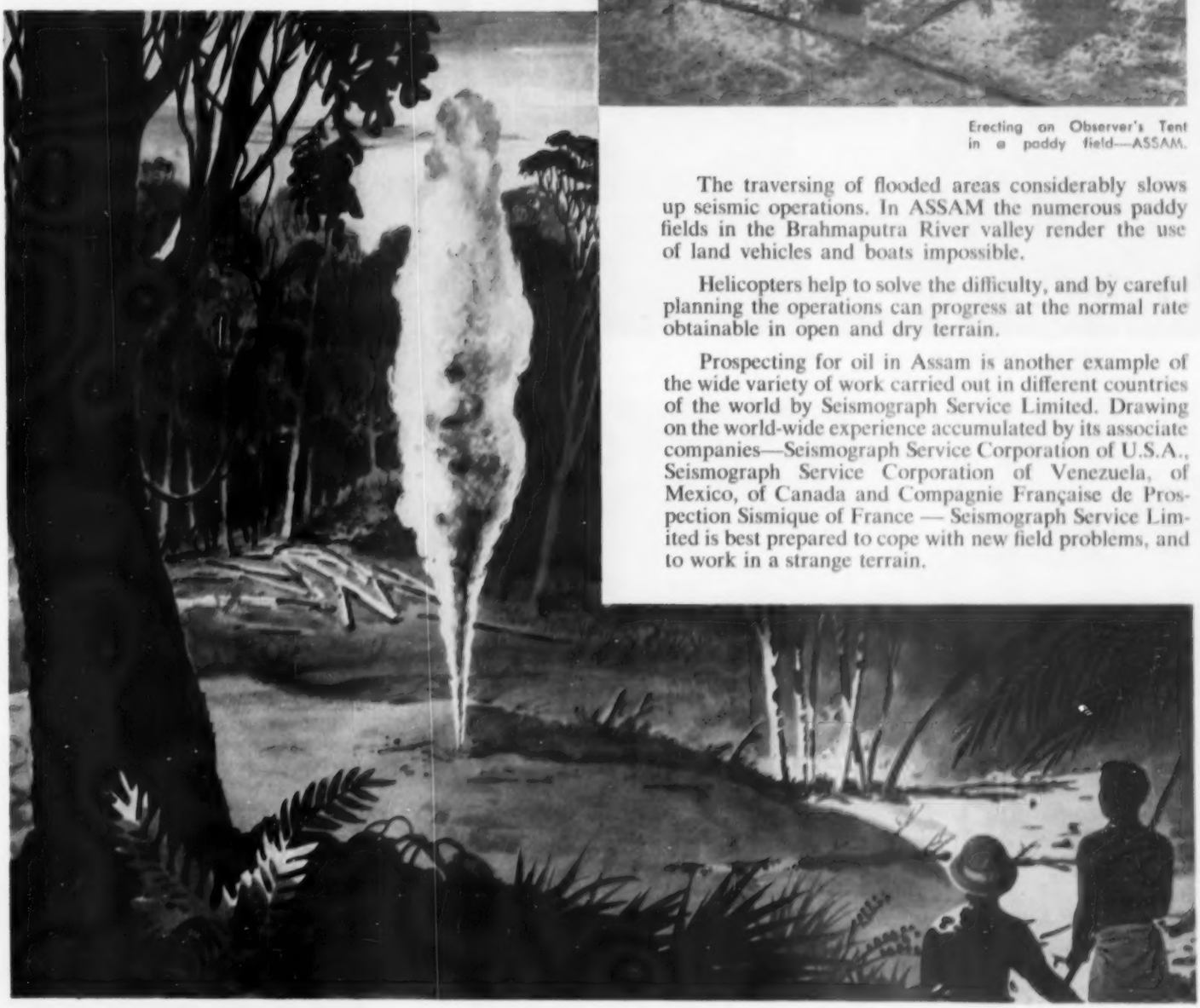
Prospecting for oil in Assam is another example of the wide variety of work carried out in different countries of the world by Seismograph Service Limited. Drawing on the world-wide experience accumulated by its associate companies—Seismograph Service Corporation of U.S.A., Seismograph Service Corporation of Venezuela, of Mexico, of Canada and Compagnie Française de Prospection Sismique of France — Seismograph Service Limited is best prepared to cope with new field problems, and to work in a strange terrain.



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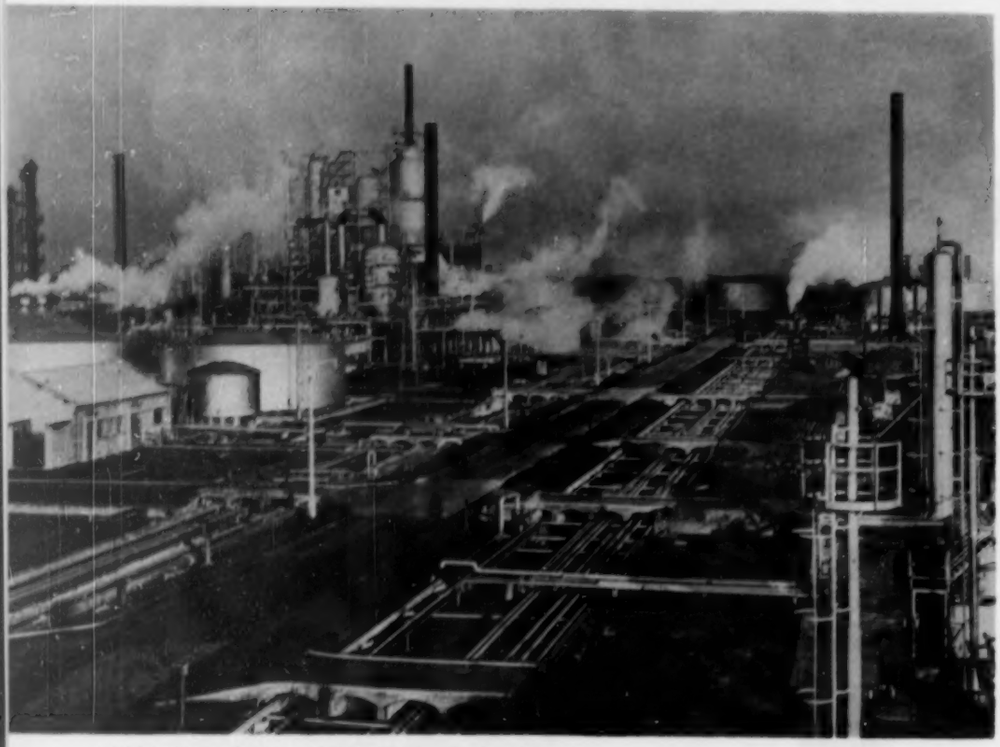

*General view of the Grangemouth refinery.*

*Tanker "British Sailor" discharging crude oil at Finnart oil depot, Loch Long, Scotland.*

# GRANGEMOUTH

THE HISTORY of Grangemouth refinery, located near the eastern shore of Scotland, strikingly reflects the changes that have taken place in the petroleum industry over the past several decades. Originally built by Scottish Oils Ltd., which was engaged in the refining of shale oil at Pumpherston, its site was acquired by that company in 1921 and for a quarter century operated at a gradually increasing capacity which by 1950 had reached 650,000 tons per year.

The rapid expansion of demand for refining capacity in the United Kingdom in the period following the late war led the British Petroleum Co. (then the Anglo-Iranian Oil Co. Ltd.), which was the owner and operator of Scottish Oils, to decide upon the enlargement and modernization of Grangemouth for processing a part of its crude supply from the Middle East. These crudes were moved in ocean-going tankers of deep draft and a survey of the Firth of Forth, which had been originally proposed as a terminal for crude deliveries, showed that it was not adapted to this purpose. Accordingly a decision was reached to locate the crude oil installation at Finnart on Loch Long, off the Firth of Clyde, and to make deliveries to Grangemouth by a 12-inch pipe line, 57 miles long, extending across central Scotland from west to east, to supply the refinery with its annual requirements of 2,500,000 tons of crude. The Finnart terminal is now handling tanker cargoes up to 32,000 tons deadweight. The landlocked harbor at Grangemouth is able to accommodate the smaller sized vessels used in the distribution of products. Another advantage of utilizing the Grangemouth site is that it contains the works

# REFINERY *enters new career*

of British Petroleum Chemicals Ltd. which uses gases from the refinery as feedstocks. Another company that obtains its materials from Grangemouth is Forth Chemicals Ltd.

The final step in launching Grangemouth on its new career was its separation from Scottish Oils Ltd. and the organization of a new company, Grangemouth Petroleum Refinery Ltd. In its new estate, Grangemouth is equipped with crude distillation, vacuum and catalytic cracking units and all the other accessories of modern refining.

One of the important features in the equipment of the plant is its electrification, which was carried out by Metropolitan Vickers and covers both the crude terminal and the refinery itself.

The power station, in addition to supplying the necessary electrical energy, also provides process steam for the whole installation; similarly, the cooling towers are of sufficient capacity to cater to all cooling water requirements in the refinery as well as for the power station itself. The low tension auxiliaries and lighting supplies in the power station are provided by a 32-unit 440-volt three-phase switchboard which has two type SF2/400A incoming switches mounted in the center.

When dealing with large quantities of oil, fire and explosion hazards are obviously most important factors. There are a number of methods that can be adopted in order to reduce the risk of fire so far as electrical equipment is concerned. At Grangemouth the whole area is divided into two portions. In the first, the services area, only normal precautions need be taken. This area contains the power station, offices, laboratories, workshop and stores. The second area contains the refinery processes, blending, storage and wharfage facilities. Here all electrical equipment, irrespective of its duty, is of fully flameproof construction, with exceptions (owing to practical difficulties of manufacture) in the case of power transformers, the coils of which are in any case immersed in oil, and certain process control instruments having "intrinsically safe" circuits are in air-purged cases.

Electrical distribution is carried out by means of radial feeders, primarily at 11 kv. From the main switchboard at the power station, three feeder cables are taken to each of seven area substations, four being situated in the refinery and tank farm areas and three in the BPC. area. These area substations are all of similar design. The impedance of these transformers, together with that of the feeder cables, reduces the required breaking capacity of 25 MVA.

With large-scale chemical processes such as oil refining, a shut-down is usually an expensive occurrence because of loss of output and the high cost of restarting the plant. As a safeguard, therefore, all important supplies are duplicated. This also allows units to be withdrawn from service for repair or maintenance without shutting down the plant.

In the case of the 11-kv supply from the power station to the area substation, the feeders are triplicated, power being normally supplied by two feeders with provision for automatically switching in the third should one of the feeder circuit-breakers trip out for any reason. In the event of a fault on one of the feeder cables, it is necessary to ensure that the faulty feeder is isolated both at the power station and at the substation in order to prevent a feed-back into the fault. This is accomplished by means of intertripping contacts on both the 11-kv main switchgear and the 3.3-kv flameproof substation circuit-breakers with the necessary pilot wires. In a refinery the bulk of the electrical power required is used for pumping duties with a small proportion for lighting, instrumentation and other services, including occasional maintenance welding. So far as is possible the various pumps at Grangemouth are installed in a number of pump-houses situated throughout the refinery, each pump being provided with a pedestal control station containing flameproof "start" and "stop" pushbuttons and a flameproof transformer-operated ammeter. These control stations are connected to flameproof contactor control boards installed in a separate room in each pumphouse. In certain processes such as blending it is more convenient to group these control stations together into the form of a control desk instead of locating them beside their individual pumps.

For all the various processes Metropolitan Vickers has supplied for the Grangemouth project more than 300 flameproof type SF switches; 200 flameproof starters and remote control stations; 163 flameproof street lighting points; and 27 non-flameproof street lighting points. Included in the motors and starters are over fifty equipments suitable for a 3.3-kv supply.

In addition, further equipment is at present in hand to meet the extensions that a project of this nature must continually be making.

# Washington PIPE LINE

By Joseph B. Huttlinger

## Cabinet committee outlines plans for oil, gas and coal

COMING IN THE midst of Congressional efforts to work out a legislative program applying to some of the main natural resources of the United States, the report released at the end of February by the special committee appointed by the President in July of last year to study this specific subject has become the core of discussion because it contains definite proposals for dealing with the separate, but related problems placed before it and outlines a national policy which may be of influence for years to come.

When the committee was named on July 30, 1954, it included seven members of the Cabinet (the Secretaries of State, Treasury, Defense, Interior, Commerce and Labor and the Attorney General), with Dr. Arthur S. Fleming, director of the Office of Defense Mobilization, as chairman. The task assigned to it was "to evaluate all factors pertaining to the continued development of energy supplies, resources and fuels in the United States, with the aim of strengthening the national defense, providing orderly industrial growth, and assuring supplies for our expanding national economy and for any future emergency."

The report of the committee deals with the broad problems of national conservation indicated in the directive, but the parts that attract greatest interest at the moment are the portions relating to issues very much to the fore affecting the three great energy industries of oil, gas and coal.

Coming shortly after the decision of the Supreme Court in the much discussed Phillips case, which fastened the grip of federal price control for the first time upon independent producers of natural gas, the question raised by that decision was a natural one for the committee's consideration. Since the production of gas is closely associated with that of oil, the action affects both. In the opinion of most oil and gas men, it already is having a deterrent effect on the development of both industries and if it remains in force will have still more serious effects in the future.

On this question the committee expresses itself unequivocally. "We believe," says the report, "the federal government should not control the production, gathering, processing or sale of natural gas prior to its entry into an interstate transmission line." Beyond this, "each operation of such companies should be treated by like criteria according to its appropriate industry function." It would bar below cost sales to industrial users and proposes the grant of eminent domain authority to permit gas companies to acquire underground storage.

A condition stipulated is that when the Federal Power Commission is considering the authorization of a gas line across state borders, it must make certain that the field price of gas to be purchased has been competitively arrived at.

Bills to remove price control from gas production are before Congress now and the authors and supporters of these bills point out that they are drawn to accomplish the committee recommendations. On the other hand, the advocates of more and more government control are highly critical of the report. Senator Paul Douglas, who is a leading figure in this group, has attacked the proposal as opening the way to higher costs to the consumer and as a "gold mine" for large gas producers.

On the knotty question of oil imports, the committee brings forward a treatment that has been discussed within the industry, but has never before been offered with official backing. The suggestion is that imports of crude oil and residual fuel be held in future in the same ratio to domestic production that existed in 1954.

Statistically, imports of crude petroleum during 1954 averaged 656,000 barrels daily, or 10.3 percent of domestic crude oil production. Imports of products, of which 90 percent is residual fuel oil, came to 396,000 barrels daily or 6.3 percent of domestic crude production. Under the proposed plan, these percentages would be maintained; a rise in crude oil imports could come only with a rise in domestic crude production.

However, the committee's suggestion is that the balance should be kept by "voluntary, individual action," the report expressing hope that there will be no need for "governmental intervention." Slight variations from time to time in relative positions might be ignored, but if imports "exceed significantly" the fair level, then "appropriate action should be taken." Different conditions might suggest changes; therefore the "proportionate relationships" should "be reviewed from time to time."

A White House spokesman commented that "the logical way" to maintain the balance is for each company to hold imports at the levels it brought in during 1954. The importing companies should on their own make room for any additional companies wanting to bring in foreign oil, such as the 10 American companies who are seeking to join the Iranian consortium. A round table conference of oil importing companies is disapproved, for "all the statistics on imports and production are public; it is perfectly simple for everyone to read them and to act upon them; there is no authorization for industry agreements; if this occurs, the Attorney General is free to proceed under the anti-trust laws."

Past attempts to limit imports to quotas or stated tonnages have been unsuccessful. Even those who complain that increasing shipments of foreign oil are unduly hampering domestic production admit that imports are necessary. Those who view the matter from the viewpoint of national defense feel that the need for foreign produced supplies might be increased greatly by some future international crisis. Many members of the industry who feel that imports should be restricted fear that to do this by law would be opening the door to complete governmental control and oppose it for that reason.

The third major section in the report calls for a series of steps to aid the coal industry which complains of unemployment and a declining demand. In addition to the hold-the-line program on oil imports, the report calls for a revision of freight rates on coal, asks foreign countries to open their doors to more American coal and proposes governmental support for exports.

Studies by the Defense and Interior departments are proposed to deal with the adequacy of present and prospective oil refinery capacity, the dispersal of refineries as a measure of safety and measures needed to maintain sufficient capacity for defense, particularly the facilities operated by small independent refiners.

The committee approves continuing adequate tax incentives for oil, coal and gas, but it is understood that this implies no questioning of the soundness of present provisions, but is based on the feeling that they should be reviewed from time to time.

The spade work for the committee study was done by a task force composed of J. Ed Warren, former president of the Independent Petroleum Association of America and now an officer of the National City Bank of New York; Charles J. Potter, president of the Rochester and Pittsburgh Coal Co.; James F. Brownlee, a partner of J. H. Whitney & Co., New York; and retired U. S. District Judge Robert N. Wilkin. Task force assistants included Richard G. Gettell of The Texas Co.; Richard J. Gonzales of the Humble Oil and Refining Co.; Minor S. Jameson, Jr., of IPAA; Serge B. Jurenev of Continental Oil Co.; and C. Pratt Rather of Southern Natural Gas Co., Birmingham, Ala.

*(Continued on page 62)*

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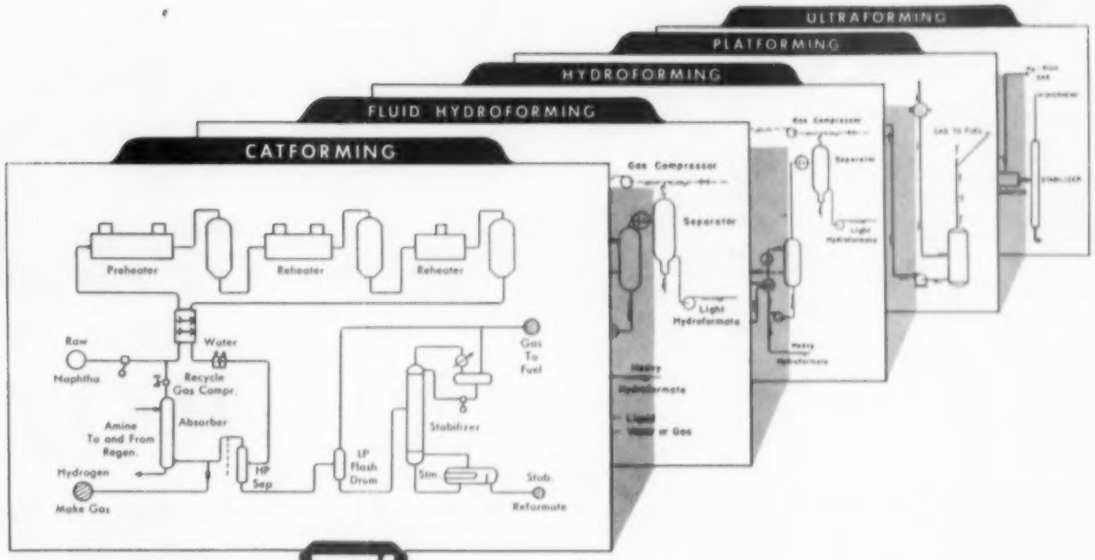


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# FOSTER WHEELER

## Washington Pipe Line

*(Continued from page 60)*

### *Antitrust Study Completed*

A committee of 60 antitrust law experts has completed the most exhaustive study of those laws in decades and is convinced that changes are needed with respect to their provisions and use outside the United States.

The opinion of the committee is timely and important in view of the fact that the U. S. government a few years ago opened an antitrust crack-down against five American petroleum companies operating in the Middle East on charges they conspired to fix prices and supply. That action, modified from criminal to civil, is still pending. A major view of the committee in this field is that American companies operating abroad should be immune from antitrust prosecution for practices or agreements in which they are compelled to join as a condition of doing business. Specifically, the committee feels, this immunity should apply to agreements to maintain prices, which would be illegal in the United States.

The committee also feels that the law should apply to operations of American firms abroad only where these have a substantial impact upon the competitive situation in the United States and where the operations are intended to have such impact.

The State Department, the committee feels, should act to protect an American firm abroad which may be caught in a situation where United States courts might find a contract or a practice illegal and where an attempt is being made to enforce the contract in foreign courts.

As a general rule, further, the committee suggests that the United States encourage combinations of American firms to do business abroad. One reason is to permit sharing of the high costs and high risks of such operations. At the same time, the committee emphasizes that it is not in favor of combinations, either at home or abroad, designed to fix prices. It would allow the cartel agreements only when to do otherwise would mean the United States firm could not operate abroad.

As a practical matter, the triggering of any antitrust crackdown against American firms doing business abroad should come only after the Department of Justice has conferred with other agencies interested. The State Department, Foreign Operations Administration and the National Security Council might be among such agencies. In the event of differences of opinion, the committee feels the President might make the decision.

At present, the practice is to consult with other departments in such cases, but the committee prefers that a formal system of conferring be established, either by administrative order or by new legislation.

A minority of the committee wants a clear-cut statement by the administration and by the Congress that the United States is opposed to cartels, and that the world should work toward ending them. A majority of the committee feels the cartel system is firmly rooted and that business must find a way to fit into the pattern without violating domestic policy.

A committee recommendation on voluntary agreements among American companies, operating at home and abroad may be important in view of the Foreign Petroleum Supply Committee of American oil companies. The committee was established under the Defense Production Act which allows companies to work together to obtain facts, to share supplies and the like. Once the Act ends, such cooperation will become subject to antitrust action by the United States government. The committee feels that expiration of the act may leave a number of joint activities still under way. It wants, therefore, a special law permitting a momentum of cooperation after the DPA has expired, to protect legitimate cooperation.

The committee wants a number of other things, for the study is as broad as the whole scope of the antitrust laws. Among the highlights:

1) The fair trade laws should be repealed. These are the laws that permit a manufacturer to set the price at which a retailer may sell and, in the event the retailer cuts the price lower, to move against him in the courts.

2) The basing point system should be recognized as a legitimate business practice broadening the area of competition.

3) In regulated industries, such as railroads, airlines, shipping and natural gas companies, the Department of Justice should have a procedure for giving its views before a regulatory agency issues orders involving possible violation of the antitrust laws.

4) Labor unions, now generally immune from antitrust action, should be brought within the scope of the acts in the event they conspire to control prices, production, markets, the number of producers in an industry, or the like. The government should be the one to act against a union, as an aggrieved employer might feel coerced and thus reluctant to act.

5) Advance clearance of proposed company or industry actions by antitrust officials is ruled out by the committee. It would not work, the committee feels, for it would involve prediction of just how a proposed practice might apply when in operation. But the committee favors informal advance conferences with antitrust officials.

6) The committee is also in favor of a number of steps to give manufacturers and retailers greater freedom to lower prices, and thus to pass on to consumers the benefits of competition.

Thus, price cutting in order to meet competition is approved, even though it may mean injury to a third party, perhaps a competitor or a buyer, through reduced margins. This was the heart of the Detroit case, involving Standard Oil Co. (Ind.) and its relations with the wholesale segment of the industry.

Further, a manufacturer should be free, in good faith, to reduce prices in some areas, but not in others; to some buyers but not to others; to grant functional discounts, that is, a lower price to a wholesaler than a retailer; and to lower the price for a quantity purchase, such as for tires, almost without limit.

Any legal requirement that a manufacturer should be responsible for the retail prices of his customers should be ended, the committee feels. At the same time it makes clear that if there is collusion or conspiracy to take over a market or injure competition, it should be subject to legal attack.

The committee is under the chairmanship of S. Chesterfield Oppenheim, professor of law at the University of Michigan. It was named by Attorney General Herbert Brownell, Jr., about two years ago to make an exhaustive study of the antitrust laws.

### *Federal Power Commission*

A complete new roster of members is taking over at the Federal Power Commission under appointments of President Eisenhower. Since he entered the White House, the President has named four new members to the commission. The fifth member, Claude Draper, has another year before his term expires.

The Eisenhower appointees to the commission are: Jerome Kuykendall, Washington, chairman; S. L. Digby, Louisiana; Frederick L. Stueck, Missouri, and William R. Connole, Connecticut.

Mr. Connole is to take office in June when the term of Nelson Lee Smith of New Hampshire comes to an end. Mr. Smith, a member of the commission since 1943, is resigning to enter private business.

Upon joining the commission, Mr. Connole will be 32, the youngest man ever to serve on the body.

The commission also will have the oldest person serving upon any important commission in Washington in the person of Claude Draper, who is 74. Mr. Draper has been a member of the commission since it was created in 1930. He was named by President Hoover.

Mr. Connole, an independent in politics and regarded as a liberal, is a 1949 graduate of the Georgetown University School of Law, Washington. He was with the Interstate Commerce Commission for two years before joining the Connecticut Public Utilities Commission in 1950 as chief legal officer.

### *Retail Gasoline Sales Up Ten Percent*

Retail sales at gasoline stations in 1954 climbed nearly 10 percent over 1953, according to figures made available by the U. S. Census Bureau.

Total sales came to $11,455 million last year, and to $10,537 million in 1953. Figures by months are tabulated below:

| | 1953 | 1954 |
|---|---|---|
| | ($ MILLION) | |
| January | $779 | $855 |
| February | 752 | 801 |
| March | 810 | 870 |
| April | 826 | 903 |
| May | 889 | 955 |
| June | 916 | 989 |
| July | 971 | 1,052 |
| August | 960 | 1,026 |
| September | 908 | 975 |
| October | 914 | 1,017 |
| November | 898 | 994 |
| December | 914 | 1,008 |
| Total | $10,537 | $11,445 |

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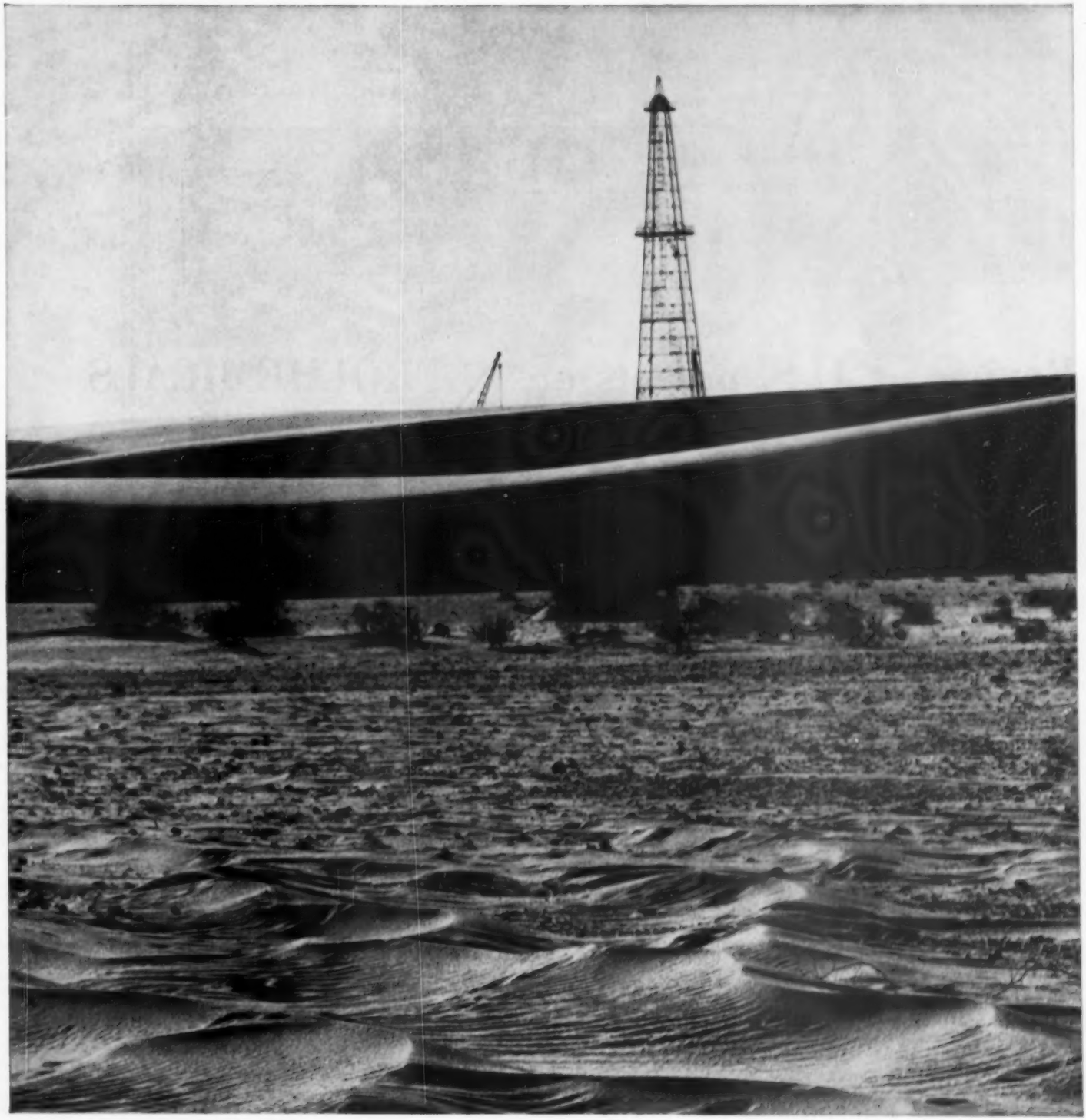

*"The oil industry has prospered by creating wealth that did not exist before. By the application and investment of capital and brains and ability it has produced oil from the earth — in some places in the middle of desert wastes, in other places under water. Where there was nothing, it found a valuable raw material. It has created wealth, and nobody has lost any money or given up any of his rights."*

*—From an address by Eugene Holman, Chairman of the Board, Standard Oil Company (New Jersey)*

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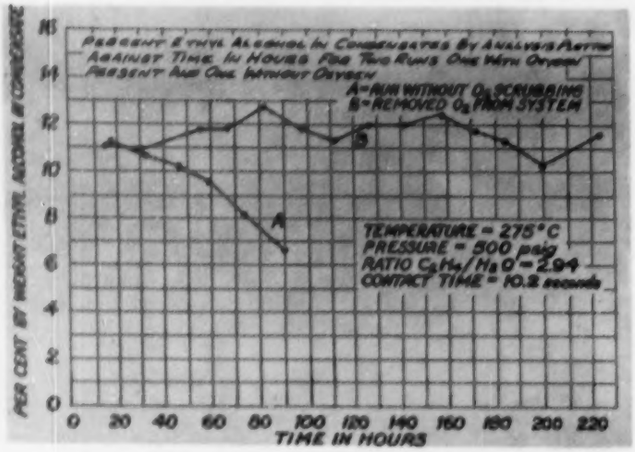
PERCENT ETHYL ALCOHOL IN CONDENSATES BY ANALYSIS PLOTTED AGAINST TIME IN HOURS FOR TWO RUNS ONE WITH OXYGEN PRESENT AND ONE WITHOUT OXYGEN
A=RUN WITHOUT O2 SCRUBBING
B=REMOVED O2 FROM SYSTEM
TEMPERATURE = 275°C
PRESSURE = 500 psig
RATIO C2H4/H2O = 2.94
CONTACT TIME = 10.2 seconds
PER CENT BY WEIGHT ETHYL ALCOHOL IN CONDENSATE
TIME IN HOURS

*A supported phosphoric acid catalyst is used in the reaction of ethylene and steam at elevated pressure and temperature: U. S. Patent 2,673,221, R. J. Schrader et al, to Eastman Kodak Co.*

# Review of U.S. patents on PETROCHEMICALS

**By Heinz Heinemann and Felix Heinemann**

THE CURRENT REVIEW, covering a selection of patents issued during the past year, deals with petrochemical subjects not discussed in recent reviews of petrochemical patents. While none of the four fields covered here (olefin hydration, hydrocarbon oxidation, acetylene production and production of nitriles) is particularly large or represented by very large numbers of new patents, each is believed to be significant in that they involve the production of basic chemicals from which many other important products are manufactured. And while the number of patents issuing is not as large as for some other subjects, the inventors are connected with many different companies, an indication that active investigations in those fields are carried out in a large segment of the industry, testifying to the potential inherent in success.

## *Hydration of Olefins*

Even though the yields of lower alcohols obtainable by hydration of olefins are thermodynamically limited and relatively low per pass at the conditions normally employed, the attractiveness of this procedure has been established in many years of commercial operation and the search for better and more efficient catalysts continues. The catalyst over which a mixture of olefin and water is passed according to Socony-Vacuum Oil Co. patent 2,663,744 (L. J. Lukasiewicz and W. I. Denton) consists of a porous, adsorptive, inorganic oxide gel comprising alumina, silica, zirconia or thoria which has been pretreated with water at reaction condition, namely, 250-700°F and 375-600 psi. A silica-alumina mixture in a ratio of 87.5 to 12.5 percent can be employed. A supported phosphoric acid catalyst is used in the reaction of ethylene and steam at elevated pressure and temperature, following the disclosure of R. J. Schrader, H. S. Young and H. L. Berntsen (2,673,221 to Eastman Kodak Co.) Considerable amounts of inert gaseous impurities can be contained in the recycle stream, but the free oxygen content must be kept below 0.2 percent. This is shown in the graph reprinted with this article. N. Levy and R. K. Greenhalg in 2,683,753 (to Imperial Chemical Industries) describe a method of producing isopropanol from water and propylene at 250-290°C and 100-500 atmospheres pressure. The catalyst is blue tungsten oxide ($W_2O_5$) and the reaction is carried out in the presence of an excess of liquid water. A space rate of 0.25 to 1 kg. of propylene per liter of catalyst per hour is employed.

## *Oxidation*

The preparation of olefin oxides from olefins continues to be a much worked on reaction. Major emphasis seems to be on the development of new or improved catalysts for the production of these important intermediates. R. B. Egbert in 2,653,952 (to Chempatents, Inc.) reacts ethylene and oxygen on silver surfaces at temperatures in the range 220-350°C, using helium as an inert carrier gas. In another Chempatents patent (2,687,380, A. Laffer) a method for restoring the activity of a deactivated silver catalyst is described. The catalyst which had previously been used in the oxidation of ethylene is contacted at 220-350°C with a gas mixture containing 0.8-4 vol. percent of ethyleneoxide. The ethyleneoxide, which is the essential agent for increasing the catalyst activity, may be introduced intermittently or continuously into the feed gas stream comprising ethylene and oxygen. E. L. Tollefson (2,686,762 to The National Research Council of Canada) discloses a method of activating silver bearing catalysts for the oxidation of ethylene and similar hydrocarbons by treating a silver-alkaline earth metal alloy having at least 25 percent silver on its surface and from which a substantial part of the alkaline earth metal has been removed with carbon dioxide at 260-350°C for a prolonged period of time. In producing a supported silver surface catalyst for the oxidation of olefins, D. K. Sacken (2,671,764 and 2,671,766 to Jefferson Chemical Co.) incorporates alkali metal sulfate in the catalyst as a promoter. The alkali metal sulfate selectively promotes partial oxidation to olefin oxides and represses complete oxidation to carbon dioxide. Silver catalysts in accordance with this invention are produced by coprecipitating silver oxide and a silver salt more water soluble than silver oxide (such as, for instance, silver sulfate). The salt is then removed from the coprecipitate and the residuum deposited on a support such as alumina.

A 20-30 percent yield increase in the production of olefin oxides from olefins and oxygen is claimed in a Shell Development Co. patent (2,680,752, H. H. Voge and L. T. Atkins) by passing a mixture of olefin and oxygen through a solid metallic silver catalyst at 150-400°C. Selemium, tellurium or their compounds have been added to the catalyst in amounts of 0.001-0.05 percent of the silver.

C. O. Berg (2,684,967 to Union Oil Co. of Calif.) is primarily concerned with recovery of olefin oxides from the reaction mixture obtained in an oxidation of ethylene or propylene. The effluent reaction gas is contacted in a separation zone with a compact moving bed of granular adsorbent. The rich adsorbent is moved in compact form through a conveyance zone with a concurrent stripping gas. The lean adsorbent then passes through a sealing zone countercurrent to a sealing gas and olefin oxides are removed with the stripping gas.

Iso-butylene is oxidized with molecular oxygen in a vapor phase non-catalytic process according to Universal Oil Products Co. patent 2,683,174 (A. J. deRosset). Aldehydes, ketones and alcohols are formed at 180-300°C and at 30-150 atmospheres pressure. The reactants are preheated sufficiently to maintain the oxidation reaction. A catalyst for the oxidation of unsaturated hydrocarbons in vapor phase is described by J. F. Matejczyk (2,698,306 to The O. Hommel Co.). It consists of the reaction product obtained by fusion at 900 and 1500°C of a mixture of an oxide of tin, zirconium or titanium in properties of 50-97 percent, an inorganic vanadate compound having a volatile cation (1-10 percent calculated as $V_2O_5$) and 1-5 percent alumina.

Acrolein can be produced from propylene rich gases by passing them in admixture with oxygen over an oxide of tellurium (2,662,921, W. R. Middleton to Socony-Vacuum Oil Co.). Other organic substances which contain activated methyl or methylene groups, such as olefins, acetylenes, cyclo-olefins, etc., can also be oxidized over this catalyst.

A Celanese Corp. of America patent (2,700,677, K. D. Brown and D. R. Keck) is concerned with the partial oxidation of propane and butane in vapor phase with oxygen-containing gas. The peroxides formed are decomposed, the hot reaction gases of 800-900°F are cooled in less than 0.7 seconds to about 500° by heat transfer with a solid and the partially cooled gases are then quenched by direct contact with a liquid medium. An autothermic apparatus for the production of unsaturated from saturated hydrocarbons by partial oxidation is disclosed in 2,700,594 (J. L. Bills to Union Oil Co. of Calif.). A gas mixture comprising vaporized hydrocarbons and an oxygen containing gas is divided into two equal parts. Each is introduced into opposite ends of a divided reaction zone of special construction. Each part reacts at high temperature in indirect heat exchange with the other part.

The oxidation of high molecular weight nonbenzenoid hydrocarbons having at least 16 C atoms/mole is described in patent 2,682,553 (J. C. Kirk and E. R. Baker to Continental Oil Co.). The hydrocarbons are mixed in liquid phase with minor amounts of a polyvalent metal salt of long chain fatty carboxylic acids having at least 12 C atoms or of naphthenic acids and with a manganese dioxide catalyst of less than 80 microns particle size diameter. A stream of oxygen containing gas is passed through the liquid phase which is substantially anhydrous and free of naturally occurring fatty materials.

The oxidation of cyclic hydrocarbons and compounds occupies a considerable part of the recent patent literature on oxidation. Aromatic hydrocarbons, such as benzene or toluene are oxidized to phenols by a vapor phase treatment disclosed in Dresser Operations, Inc. patent 2,662,923 (W. H. Reeder, III). Oxygen admixed with at least an equal volume of sulfur dioxide is used as the oxidant at 230-600°C and 100-300 psig in the presence of a solid adsorptive material, such as alumina. J. R. Darby (2,674,582 to Monsanto Chemical Co.) produces maleic anhydride from benzene by oxidation over finely subdivided silica impregnated with vanadium

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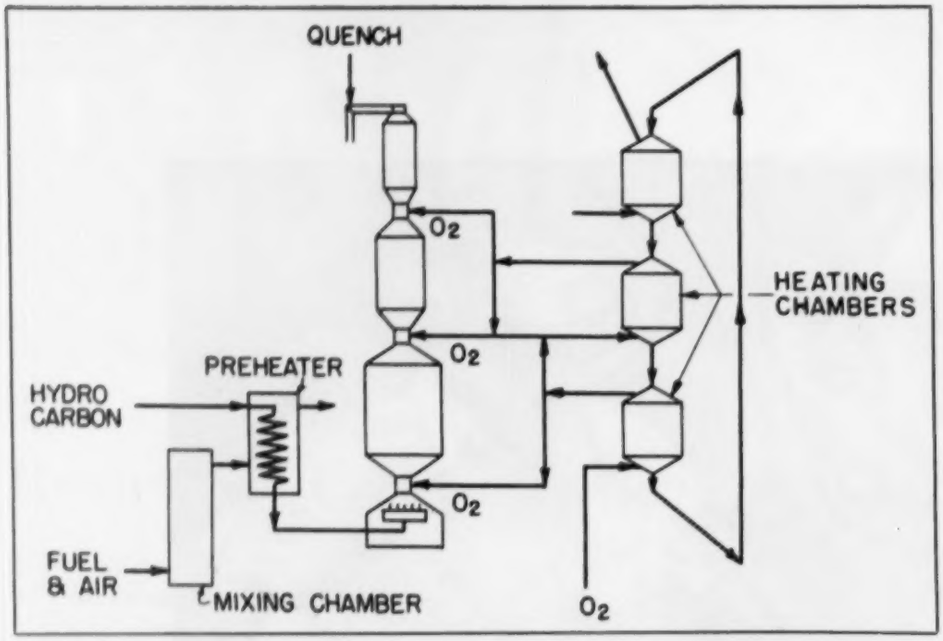



*Apparatus for the dehydrogenation of hydrocarbons to acetylenes in the presence of oxygen: U. S. Patent 2,683,653, S. P. Robinson, to Phillips Petroleum Co.*

compounds. The silica particles are bonded together by a matrix of refractory glass of high silica and low basic content. The portion of the catalyst bed which comes in initial contact with the reaction mixture consists substantially of over 4 mesh particles, while the rest of the bed consists of particles of a 4-6 mesh size. Substituted aromatics are directly oxidized to acids in a homogeneous phase catalytic process disclosed by D. C. Hull (2,673,217 to Eastman Kodak Co.). Cobaltous acetate or a salt of manganese, iron, nickel, copper or other metals with a lower aliphatic acid is used as the catalyst in solution. The oxidation is carried out with oxygen containing gas at 5-90°C in the presence of acetaldehyde. Patent 2,653,165 (I. E. Levine of California Research Corp.) deals with the oxidation of toluic acid esters of low molecular weight alkanols to the corresponding mono-esters of phthalic acids at 300-500°F.

The production of tertiary hydroperoxides is the subject of Hercules Powder Co. patents 2,664,447 and 2,664,448 (E. J. Loremal and J. E. Reese). Alkyl substituted aromatics containing two alkyl groups and one alkaryl group are treated with oxygen in liquid phase in the presence of heavy metal oxides, hydroxides or organic acid salts. These catalysts are used in concentrations of 0.15-0.8 percent of the aromatic. P-diisopropylbenzene may thus be oxidized over manganese naphthenate or cobalt linoleate.

### *Production of Acetylene*

The importance of acetylene as a building stone in chemical synthesis has steadily increased since the German chemist Reppe developed this field before and during the last war. The number of patents issuing on methods of preparing acetylene seems to become larger and probably reflects the greater emphasis on petroleum hydrocarbons as a raw material for acetylene.

Six patents assigned to Union Oil Co. of California deal with the dehydrogenative oxidation of methane and natural gas. In 2,679,540, C. H. O. Berg reacts a preheated mixture of hydrocarbons and oxygen containing gas noncatalytically at elevated temperatures. An acetylene stabilizing gas (such as carbon dioxide, ethane, propane or butane) is injected into the reaction product. The gas stream is then contacted with a moving bed of granular adsorbents to separate acetylene and unreacted hydrocarbons from hydrogen and other products. In the same inventor's patents 2,679,541 to 2,679,544, a hydrogen-rich gas is injected into the preheated reactant mixture. J. L. Bills in 2,698,349 produces acetylene from methane and an oxygen containing gas at 1,100-1,500°C and 0.005-0.02 seconds contact time. Hydrogen, preheated to reaction temperature, is admitted to the gas mixture in a non-turbulent way after 25-75 percent of the reaction time has elapsed. Phillips Petroleum Co. patent 2,683,653 (S. P. Robinson) discloses an apparatus (shown in the drawing) for the dehydrogenation of hydrocarbons to acetylenes in the presence of oxygen. Hydrocarbons and oxygen are preheated separately and then mixed in a first reaction zone containing small alumina pebbles. The reaction mixture is then passed to subsequent reaction zones and additional preheated oxygen is introduced into each zone. The final effluent contains acetylene in concentrations up to 20 volumes percent based on feed. C. W. Perry in another Phillips Petroleum Co. patent (2,682,447) forms acetylene and hydrogen cyanide by pyrolysis in an electric arc of a feed of nitrogen and hydrocarbon material. The feed, immediately prior to introduction to the arc, passes rapidly upwards through a downward moving compact bed of preheated pebbles to crack a portion of the components. The coke formed is retained on the pebbles and used to reheat the pebbles by combustion. The stream leaving the arc is rapidly quenched to below 1,500°F.

Two Hydrocarbon Research, Inc. patents disclose methods of quenching the acetylene rich products formed in the partial oxidation of methane or natural gas. According to 2,692,901 (P. W. Garbo) the product gas is contacted with a higher oxide of iron in an amount of 0.2-2 lbs./cubic foot of gas. The solid particles shall have a temperature of not more than 600°F and a size range of 100-200 mesh. The product gas is cooled from 2,500° to below 800°F and the higher oxide of iron is reduced to a lower iron oxide. According to 2,692,902 (H. R. Pichler and M. C. Chervenak) the quenching step is carried out with activated carbon particles of 40-300 mesh, which carbon particles are characterized by an iodine value of not less than 100 and preferably of 500-1,200. Higher acetylenes present in the product gas are decomposed during the quenching step.

### *Production of Nitriles*

Modifications of the synthesis of acrylonitrile from acetylene and hydrogen cyanide occupy a large percentage of the patent literature on acrylonitrile manufacture. D. Porret (2,683,734 to Ciba, Ltd.) passes a gaseous mixture lean in HCN through water at 0-25°C. The resulting dilute HCN solution is contacted at 40-90°C with acetylene containing gas, recirculated from the nitrile manufacturing step. HCN is stripped from the solution and the mixture of acetylene and HCN is introduced into a cuprous salt catalyst solution. R. A. Franz (2,659,748 to Lion Oil Co.) reacts acetylene and hydrogen cyanide at superatmospheric pressure in the presence of an acqueous solution of a cuprous chloride complex and an alkane having 1-4 C atoms. The alkane stabilizes the acetylene and permits the use of elevated pressures resulting in better yields. The synthesis catalyst employed in Mathieson Chemical Co. patent 2,653,965 (R. M. Thomas) consists of a liquid mixture of cuprous chloride and alkali metal chlorides and is used at 80-90°C. The aqueous solution of cuprous chloride contains a concentration of total salts on the high side of the eutectic composition of at least 70-72 percent total salts and contains at least 1.03-1.10 moles of cuprous chloride per mole of alkali metal chloride.

Acrylonitrile is made from ethylene cyanohydrin according to 2,690,452 (E. L. Carpenter to American Cyanamid Co.) by dehydration at 170-210°C in the presence of a sodium formate catalyst and an inert particulate solid material in an amount of 1-10 wt. percent of the formate. The inert material, such as aluminum sulfate, monosodium phosphate, etc., retards the decomposition of the sodium formate during dehydration and increases the acrylonitrile yield.

A number of recent patents are concerned with the production of unsaturated nitriles. H. Heinemann (2,672,477 to Houdry Process Corp.) converts saturated nitriles to unsaturated nitriles of two carbon atoms more in the chain, by reacting the saturated compound with ethylene oxide and then dehydrating over an alumina catalyst at 300-800°F. F. J. Bellringer, T. Bewley and H. M. Stanley (2,691,037 to The Distillers Co., Ltd.) make unsaturated nitriles from $\alpha$-, $\beta$ unsaturated aldehydes by vapor phase reaction with ammonia and molecular oxygen in the presence of a metal or inorganic compound of copper, chromium, vanadium, manganese, iron, cobalt, nickel, silver, zinc, tin, tungsten, lead, platinum or gold at 250-600°C. The reaction time is less than twenty seconds. The dehydrogenation of saturated nitriles, according to Sinclair Refining Co. patent 2,671,107 L.H.V. Beckberger), can be carried out at 950-1,300°F over a solid dehydrogenation catalyst. Hydrogen cyanide is added to the feed in a HCN/nitrile ratio of at least 1:10. The yield of unsaturated nitrile is improved by the addition of HCN and the decomposition of nitriles is effectively suppressed.

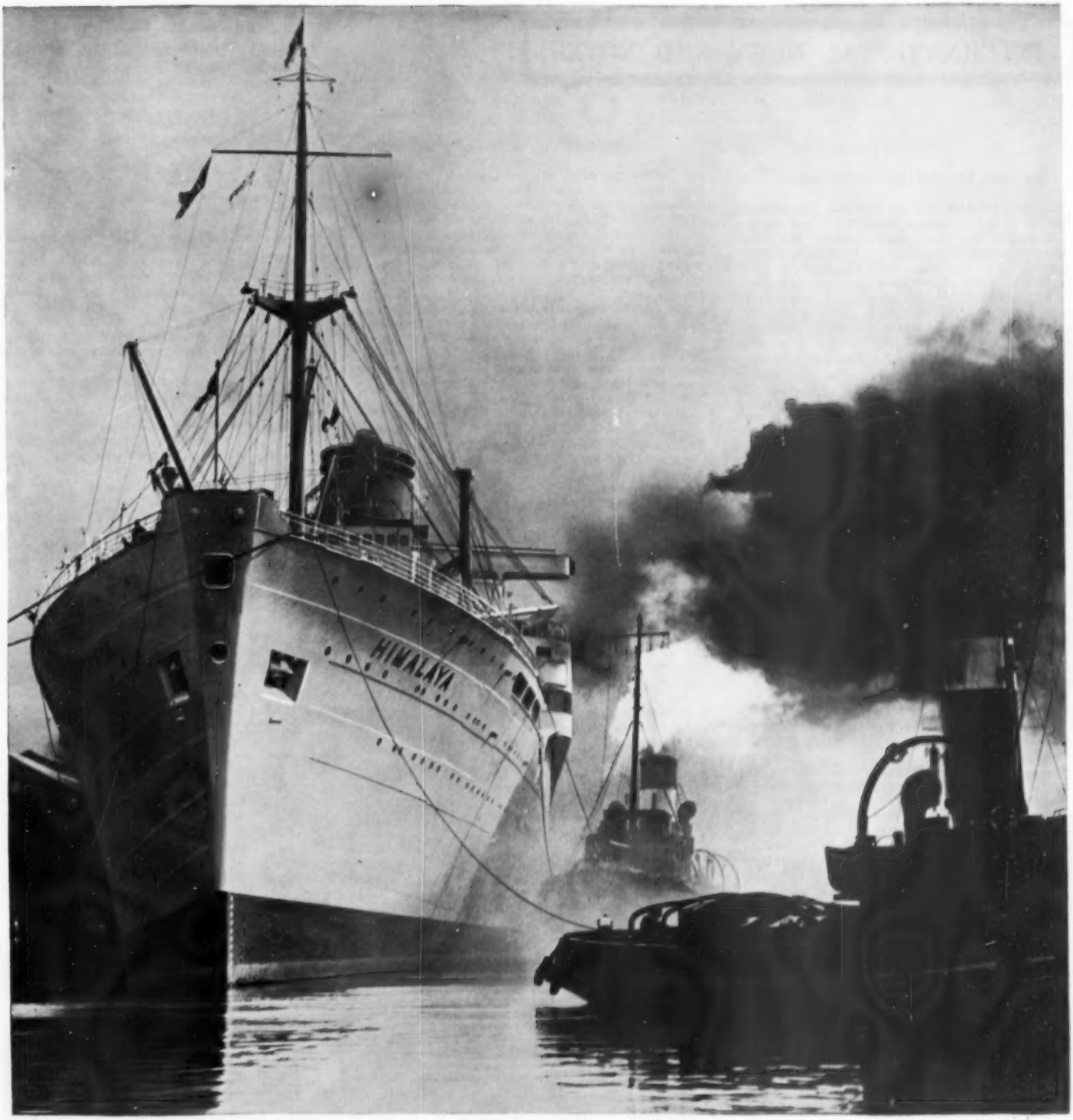
A method for making halo nitriles is contained in patent 2,653,963 (F. M. Cowen and J. K. Dixon to American Cyanamid Co.). Olefins are reacted with cyanogen halide in the presence of an aluminum chloride-nitrohydrocarbon at temperatures of 25-55°C. The corresponding aluminum bromide compound or boron trifluoride-nitrohydrocarbon can also be employed as the catalyst.

Polymerization of unsaturated nitriles can be inhibited by the addition of minor amounts (0.5-1,000 parts per million) of a stabilizer, following the directions of patent 2,678,943 (K. M. Taylor to Monsanto Chemical Co.). Dipyridil and related compounds are suitable inhibitors. Another inhibitor type is described in Monsanto Chemical Company's patent (2,698,338 (R. L. Meider).

Compounds of the formula

$$\left.\begin{matrix} R_1 \\ R_2 \\ R_3 \\ R_4 \end{matrix}\right\} N\text{-}X$$

are used, where $R_1$ to $R_4$ are organic radicals and X is halogen.

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# INTERNATIONAL NEWS AND NOTES

## Iranian Operating Companies

The list of directors of the two companies charged with the management of the Iranian oil industry has been made public. For the Iranse Aardolie Exploratie en Productie Maatschappij N.V. (Iranian Oil Exploration and Producing Company) they are as follows: L. E. J. Brouwer, chairman and managing director, Fathollah Nafisi, J. J. O'Brien, B. Scheffer, Abolghasem Shiva and E. E. Thorneloe.

Fathollah Nafisi studied in England and received a degree in petroleum engineering from Birmingham University in 1931. He entered the employ of Anglo-Iranian Oil Co. and after two years at Llandarcy, was transferred to Abadan and later was stationed at various fields in Iran. In 1937 he resigned to enter the service of the Iranian government where he held various important posts. From 1949 to 1955 he was managing director of Iran Oil Co. In addition to his present position he is a director of the National Iranian Oil Co.

Mr. O'Brien was formerly with The Texas Co. in Colombia and Mr. Scheffer was with Bataafsche Petroleum Mij. as manager at Balikpapan.

Abolghasem Shiva graduated as an electrical engineer from City and Guilds College in London in 1934 and spent 15 years in the service of Anglo-Iranian at Abadan and in the fields. In 1953 he was made manager of the Kermanshah refinery.

Mr. Thorneloe was formerly chief engineer of fields and pipe lines for Anglo-Iranian and went to Iraq Petroleum Co. as deputy chief engineer in 1950. From there he went to the Exploration and Producing Co.

Mr. Brouwer is chairman and managing director of Iranse Aardolie Raffinage Maatschappij N.V. (Iranian Oil Refining Co.) as well as of the producing company. Other members of the board of directors are Dr. Reza Fallah, Manuchehr Farmanfarmaian, M. Hagen, D. C. Hussey and E. E. Thorneloe, the last named being on both boards.

Dr. Fallah graduated in petroleum engineering from Birmingham University in 1934. In the following year he went to the research department of Anglo-Iranian at Sunbury and subsequently filled positions at Abadan and in the fields. From 1948 to 1951 he was manager of the company's recruiting department at Teheran. In 1951, following nationalization, he was appointed manager of Abadan and in 1955 became deputy chairman of the National Iranian Oil Co.

Manuchehr Farmanfarmaian is another graduate of Birmingham University and for several years was with the Ministry of Finance in the petroleum department, being director of the department from 1948 to 1951. In 1954 he was appointed adviser on petroleum affairs to Prime Minister Zahedi.

Mr. Hagen was formerly with Standard Oil Co. (N.J.) and before that was with Creole Petroleum Corp. in Venezuela as manager of industrial relations.

Mr. Hussey is now general manager of Abadan refinery as well as being a director. He comes from Esso Standard where he was general superintendent of the Bayway refinery.

A qualification for the Iranian directors of the two boards is at least 15 years of service in the petroleum industry, three years of which must have been spent in important positions.

Production of crude oil in South Iran from October 29 to December 31, 1954 is reported as 1,400,000 long tons. Production in January 1955 was 929,000 long tons. Refinery throughput at Abadan from October 29 to December 31, 1954 was 898,000 long tons and for January was 636,000 long tons.

The lubricating plant is operating again on a reduced scale and the staff is concentrating on rehabilitation and the production of high grade lubes.

Contracts have been let for construction of a products pipe line from Abadan to Teheran via Ahwan, the object being to ease the heavy traffic on the railway. The contract has been let in two parts, one to a French company and the other to a British firm. Part of the equipment is now on the way to Iran.

L. E. J. Brouwer is not a director of Iranian Oil Participants Ltd. nor of Iranian Oil Services Ltd. as was reported in previous correspondence.

## Saudi Arabia Gas Report

A report entitled "The Utilization of Waste Gases in Saudi Arabia" has been duplicated by the Foreign Operations Administration, and copies are being sent out to industry executives who ask for them. The report was financed by FOA, and prepared for the government of Saudi Arabia by the National Academy of Sciences. The report was described in WORLD PETROLEUM in December, 1954 and created such keen interest that the FOA decided to send copies to persons requesting them.

## Creole Dedicates New Office Building

Creole Petroleum Corp. has dedicated a new 10-story general office building built at a cost of $8 million near University City in Caracas, a rapidly developing sector in the Venezuelan capital. The building now houses 1,400 employees previously scattered in 11 buildings.

Construction of the new building was begun in January 1953 with dedication on March 15, 1954. Ten years earlier the company was housed in a single three-story structure in the Caobos district.

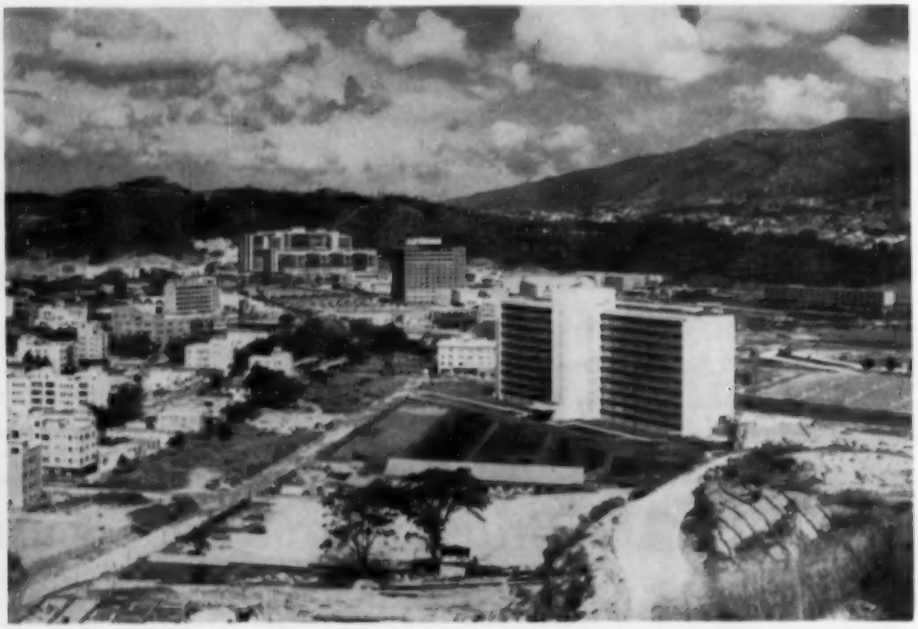
Flanked by a 2-story annex, the building lies from east to west so as to avoid the direct rays of the sun and to take advantage of the prevailing north-south breeze.

In the mild climate of Caracas, where the average temperature extremes are 50 and 80 degrees, no air conditioning was needed for the building, except on the second floor of the annex which houses the huge battery of delicate electronic computers of Creole's Accounting Department.

The building foundations rest on 1,565 reinforced concrete piles which makes the structure highly resistant to earthquakes. Approximately three million man-hours of labor went into the construction. The available floor space is much greater than the total in the 11 buildings formerly occupied by Creole. Except for the tenth floor, where the executive offices are located, and the basement, there are no dividing walls in the building. The hundreds of offices on the nine other floors are set off by movable steel partitions. A large auditorium and five conference rooms are features of the building facilities. Ceilings are covered with acoustic tile.

Outside, parking space is provided for 400 automobiles, a club-house for social events and an athletic field for sports activities, occupying large portion of the area around the building. Extreme care and considerable expense went into the landscaping of the remaining ground.

*Rear view of Creole Petroleum Corporation's new office building in Caracas. Buildings of University City are in the background. Creole photo.*



*Office of Creole Executive Vice President Harry A. Jarvis.*

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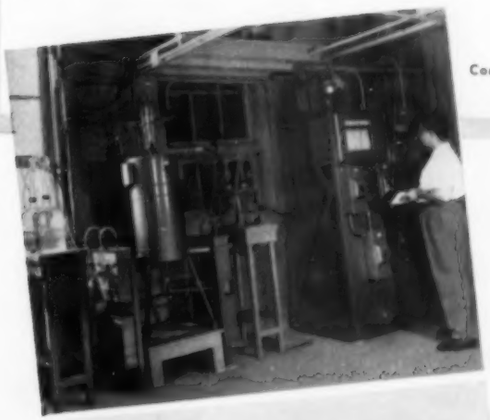

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## Gulf Strikes Oil on Italian Mainland

The exploration concession on which the recent Gulf strike in Italy was drilled is known as Abruzzi, and the site of the well is on the Adriatic side of the Italian mainland about 26 kilometers inland from the city of Pescara.

The concession is owned by the Italian company, Petrosud S.A., which is jointly owned by Montecatini, Societa Generale per l'Industria Mineraria e Chimica, Milan, an Italian enterprise with more than 250,000 shareholders and American International Fuel and Petroleum Co., a subsidiary of Gulf Oil Corp.

The well, Cigno No. 1, was completed at a depth of 776 meters, and on the basis of preliminary tests carried out over a few days, it is anticipated that it will produce about 2,000 b/d of water-free 34° API oil.

Petrosud has filed an application with the Ministry for Industry and Commerce for the grant of a production concession so as to make the oil available as soon as possible to Italian refineries. The concession would also permit the further development of oil production in the area.

If, as seems possible, this first well is the prelude to the development of a commercial oilfield on the mainland of Italy, it will be a welcome addition to that country's rather sparce reserves of indigenous fuel.

The American associate in Petrosud, i.e. Gulf Oil Corp., through its associated and affiliated companies, is actively engaged in world wide search for and production of oil.

It will be recalled that its earlier search for oil in Sicily resulted in its discovery at Ragusa, the products from this region being already refined in Italian refineries.

The exploration program in this territory is being conducted under the personal supervision of Dr. Marco P. Marchetti, chief geologist, and F. T. Kafka, geophysicist of American International Fuel and Petroleum Co.

## To Increase Capacity

Phillips Oil Co. is planning to increase the capacity of its El Roble, Venezuela wax plant to enable it to more nearly meet domestic demand for paraffin. The plant now produces about 250 tons per day and will be increased to 400-450 t/d. New presses and cooling equipment will be installed.

The Phillips refinery is operated in connection with a repressuring and natural gasoline plant. The repressuring plant injects 40 million cubic feet of gas daily into the producing formation and plans are being considered to increase this capacity. Consideration also is being given to the production of LPGas for local consumption.

## Progress on Sui Gas Line

Construction of the 348-mile Sui gas line in Pakistan is proceeding ahead of schedule according to latest reports received by the builders, D. & C. & Wm. Press of London and Morrison-Knudson Co. of Pakistan. On February 15 the job was rated as 66 percent completed.

Construction of the line was carried on in two spreads, one starting at Mile 135 and extending northward and the other working southward from the same point toward Karachi. The technical and labor force engaged in the construction included 120 British and Americans and 1,000 Pakistanis. Of the $3,400,000 expended for material and equipment $1,400,000 was purchased from the United States and about $2,000,000 from the United Kingdom.

## Houdriforming Catalyst to be Made in Europe

Houdry Process Corp. has reached an agreement with the Chemische Werke Huels A.G., at Marl, Kreis Recklinghausen, (W) Germany, under which the Huels plant will produce catalysts for use of European Houdriforming licensees. Up to now, the only source of Houdriforming catalyst had been the Houdry plant at Paulsboro, New Jersey.

## Petroleum Steel Drum Requirements In Philippines

Rheem Manufacturing Co., Richmond, Calif., estimates that its new Philippine subsidiary will supply all the 200,000 steel drums for petroleum needed each year in the Philippines.

The company has set up Rheem of the Philippines, Inc., at Manila, along with two Philippine corporations, San Miguel Brewery and A. Soriano y Cia. Rheem has applied for and obtained from the U. S. Foreign Operations Administration a guarantee (1) of convertibility of earnings into dollars, and (2) against loss of investment through expropriation or confiscation. The guaranty covers up to $450,000 of Rheem's interest.

In announcing the guarantee, the FOA said:

"While it is expected that eventually the Philippine concern will manufacture a number of the products of the U. S. Rheem company, at the outset the principal manufacture will be 55-gallon welded steel drums for storing and transporting petroleum products.

"Rheem Manufacturing Co. estimated that the 200,000 steel drums imported yearly for use in the Philippine petroleum industry cost about $1,600,000. Within two years of operations, it is believed, Rheem of the Philippines can supply the entire annual requirement, using imported raw materials costing about $700,000.

"This annual savings in dollar exchange of approximately $900,000 is an early prospect for the Philippines." "Longer term benefits," FOA said, "should result from the eventual manufacture of containers for export and from the encouragement given to increased industrial activity by the presence in the Philippines of a source of equipment for packaging, storing and transporting industrial goods."

## U. N. Corrects Report

As a result of representations from various quarters, the Secretariat of the Economic Commission for Europe of the United Nations has issued a statement disavowing newspaper dispatches which represented a recent report attributing to the commission as criticizing the price of Middle East oil as unreasonably high. The statement explains that the document in question is merely a working paper submitted to the ECE coal commission for review and discussion and that the newspaper reports are without official foundation.

The statement adds that the ECE report has been submitted in its entirety to the participating governments and will be reviewed in the light of further information presented.

## SWECO to Build Brazilian Plant

Southwestern Engineering Co., Los Angeles, has been awarded a major engineering assignment in Brazil, it is announced by Robert P. Miller, SWECO president. The contract calls for design and erection supervision for an asphalt plant and crude terminal facilities for Petroleo Brazileiro, S.A.

The asphalt plant, which will be located at Petrobras' refinery at Cubatao, will be designed to charge 3,500 b/sd of heavy crude oil.

Standard Oil Co. of California, in cooperation with Petrobras, will serve as technical advisor during the course of design and erection of the facilities.

The project is scheduled for completion in November 1955.

## Expand Japanese Refinery

A modernization and expansion program is nearing completion at the refinery of the Nippon Petroleum Co. at Yokohama, Japan. The refining company is owned jointly by California Texas Corp. and Japanese interests.

The expansion program will contribute to the production of gasoline of an octane rating to meet Japanese needs and in an increased quantity of lubricating oil, particularly oils of higher quality.

## Pemex Official Appointed to IPPC

Jose Colomo, assistant technical director of production of Petroleos Mexicanos, has been appointed vice president of the International Permanent Petroleum Council, with headquarters in The Hague, Holland, it was announced in Mexico City by Antonio J. Bermudez, general director of Petroleos Mexicanos. The Pemex chief issued a press statement hailing the appointment as of "great importance" for Mexico.

## Middle East Crude Oil Production

The following crude oil production figures for the month of January 1955 are announced:

| | LONG TONS |
|---|---|
| Iraq Petroleum Co. Ltd. (Kirkuk field) | 1,989,859 |
| Basrah Petroleum Co. Ltd. (Zubair & Roumaila Fields) | 458,192 |
| Mosul Petroleum Co. Ltd. (Ain Zalah & Butmah Fields) | 104,836 |
| Qatar Petroleum Co. Ltd. (Dukhan Field) | 405,447 |
| Kuwait Petroleum Co. Ltd. | 4,244,743 |
| Aramco (28,350,152 U. S. bbls.) | 3,831,102 |
| Iran | 929,000 |

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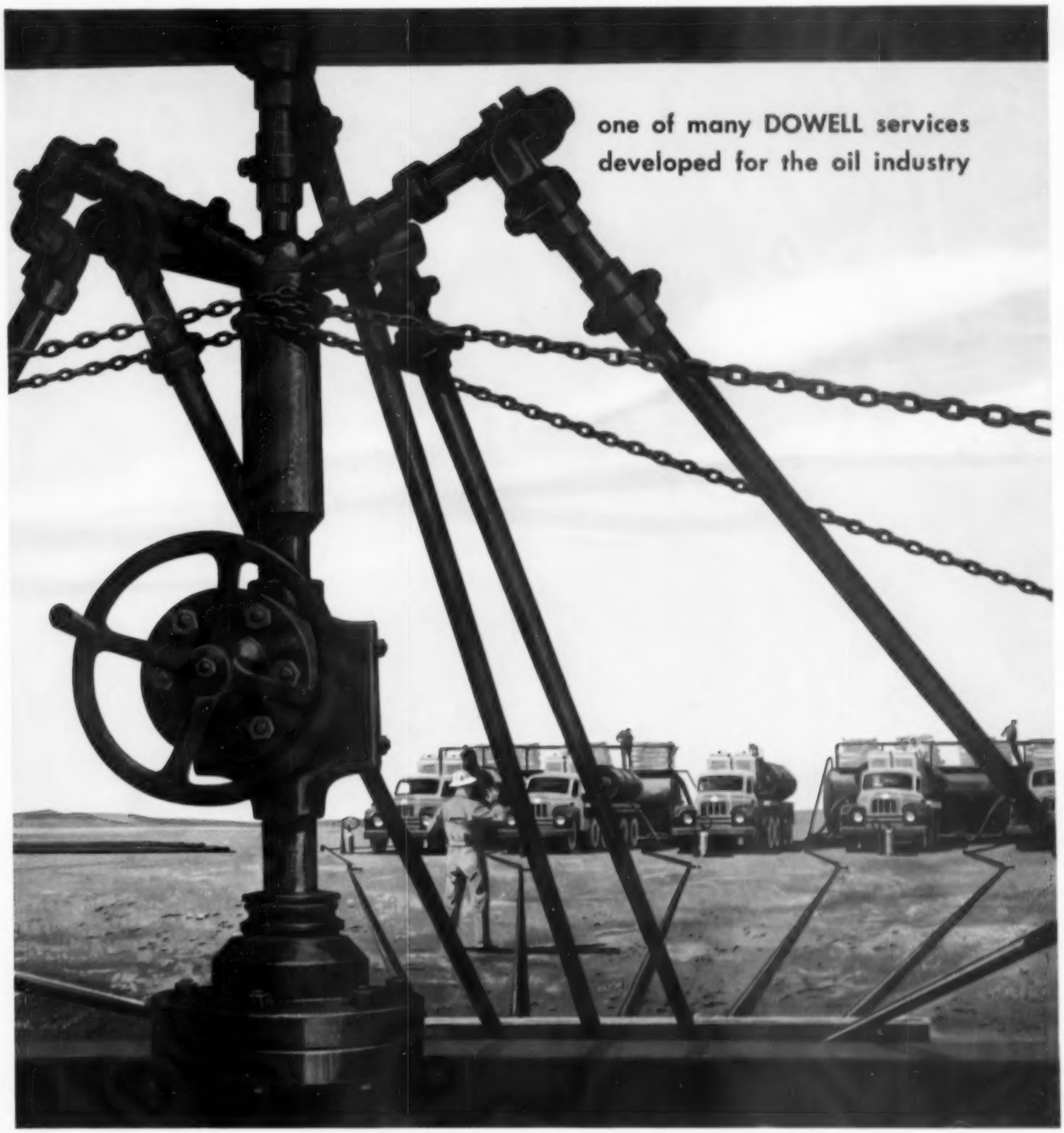


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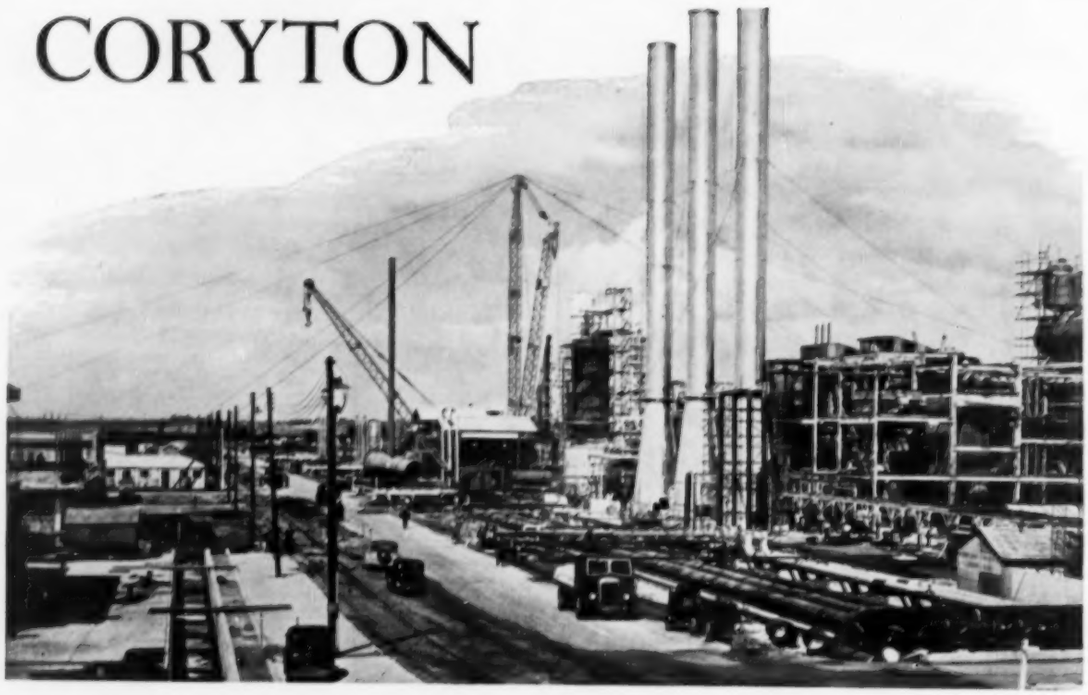

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# Metropolitan-Vickers

**Turbo-Generator Sets** Three Metrovick 5,000 kW, pass-out type condensing turbo-generator sets are to be installed. The single cylinder turbines, which are supplied with steam at 600 psig 735° F., are so designed as to pass-out steam at 140 psig and 20 psig. Under certain conditions, provision is made for steam at 20 psig to be passed-in to the turbine.

**Flameproof motors** The M-V motors at Coryton include ten horizontal flameproof 2960 r.p.m. machines—four rated at 350 hp for the Propane De-asphalting plant, two at 200 hp for the Furfural unit and four at 200 hp for the M.E.K. plant. All these motors have ball and roller bearings with forced-feed oil lubrication from a gear-driven pump.

**Non-Flameproof motors** Two Metrovick 200 hp, 740 r.p.m., vertical motors were supplied for driving water pumps.
These motors (both flameproof and non-flameproof types) are squirrel-cage induction machines connected to a 3.3 kV three phase, 50 cycle supply.

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## Named Chief Engineer for Kerr-McGee

Paul Wolff, formerly chief marine engineer of Kerr-McGee Oil Industries, Inc., has been named chief engineer, company headquarters in Oklahoma City. Mr. Wolff was recently credited with the major part in the design, development and construction of Kermac Rig 44, $2 million offshore mobile submersible drilling platform. The rig is now successfully completing its first well for Shell Oil Co. with an outstanding record of drilling performance.

## New Diesel Fuel System "Simple as a Carburetor"

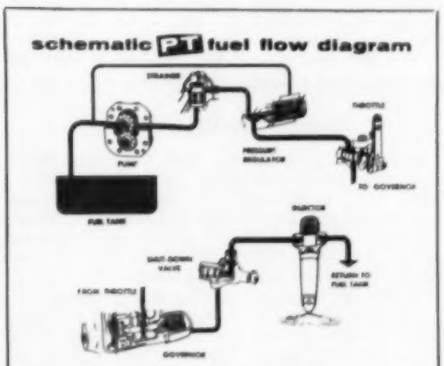
A new fuel metering and injection system has been adopted by Cummins Engine Co.. Inc. which is much simpler and easier to maintain than previous fuel systems the company has announced. The new equipment is standard on all Cummins engines manufactured since July 1 and may be applied to older engines built since 1932.

The new injector performs both metering and injection functions. Flow of fuel is continuous so that no timing is required. Check valves have been eliminated.

The Cummins PT fuel system has 182 parts compared with 415 in the previous design. Weight is reduced from 104 to 13 pounds. Field testing on 400 units has indicated lower maintenance, lower fuel costs, better acceleration and more positive throttle control. The system has been used on experimental engines with rotative speeds in excess of 4,000 rpm. This suggests that lighter weight diesel engines can now be designed.

As indicated in the schematic flow diagram, in the new system a gear pump picks up the fuel from the fuel tank, creating the basic fuel pressure for the system. This pressure is then controlled by a pressure regulator which is designed to control the maximum pressure in the system and give the proper torque and horsepower characteristics. The fuel pressure from this regulator is controlled by a very simple throttle control valve, a simple governor control valve, and an "on and off" shut-down valve. From this point, the fuel flows from the fuel pump to a common manifold leading to each of the injectors located in the engine cylinder head. The pressure from the fuel pump is applied to the metering orifice in the injectors and depending upon the pressure in the manifold, more or less fuel is metered through the orifice into the injector cup in the top of the engine combustion chamber. At the proper time for firing, the injector plunger is forced down by the action of a cam on the main engine camshaft, forcing the metered fuel through the spray holes in the injector cup.

Since all injectors are connected to the common manifold, all receive the same pressure and equal charges of fuel are injected into each of the engine's cylinders, assuring that each cylinder develops equal power without the necessity for individual adjustment of each injector.




*This diagram shows pressure regulator, throttle and governor in full horsepower operating positions.*

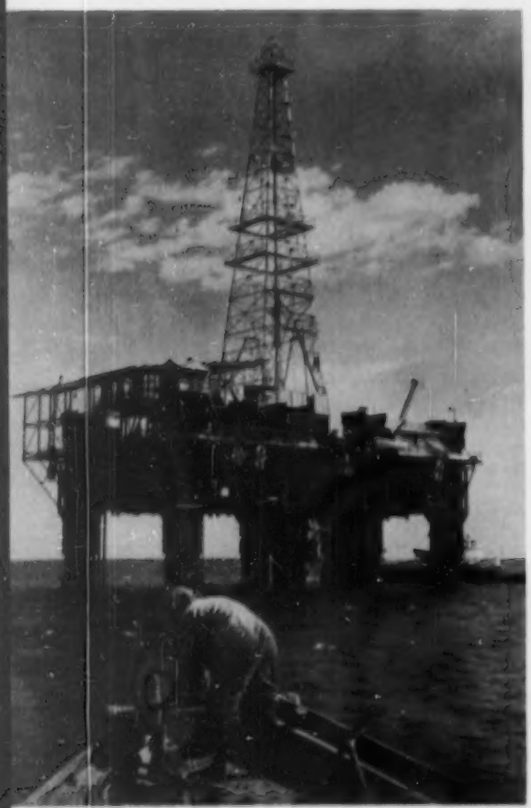
# BRITISH OIL NEWS

By E. Lawson Lomax

THE ANNUAL DINNER of the Institute of Petroleum was held at Grosvenor House on February 23 under the presidency of Lt. Col. S. M. J. Auld, who presided over a gathering of about 1,200 made up of members of the Institute and their guests. Among the latter were members of the government, representatives of the fighting services, members of Parliament and officers of scientific organizations.

The principal speaker was The Rt. Hon. Geoffrey Lloyd, Minister of Fuel and Power, who said it was his first public opportunity of expressing his thanks to both the British and American petroleum industries for the invaluable work they did during the war. He also pointed out the contribution that oil was making toward solving the fuel problem of the United Kingdom and also that the use of nuclear power would be a definite factor in the future, and concluded his speech by proposing the toast of the petroleum industry and the Institute of Petroleum.

Col. Auld, in his reply, said that the Institute was very pleased to have Mr. Lloyd present, it being the first time he had appeared at one of its major functions. He pointed out that petroleum was one of the main factors in raising the world's standards of living, and its progress in this direction during its less than 100 years of life had been most marked. In finishing he proposed a toast of the guests, coupling with it the name of Hon. Lincoln Gordon, Minister of Economic Affairs in the United States Embassy, London.



*General view of the Shell unit five miles from shore in the Persian Gulf preparing to spud in the first well in a concession acquired from the ruler of Qatar in 1952. The site is 35 miles north of Doha, capital of the independent Sheikhdom of Qatar.*

## New Test Laboratory

A new engine laboratory, to cost about £85,000, is being added to British Petroleum's existing research station at Sunbury, and is expected to be fully commissioned early next year.

One of the installations will be a chassis dynamometer room, in which a car can be mounted on rollers and road conditions simulated. In addition, wind force, air humidity, level driving and hill climbing can be adjusted. The laboratory also will include facilities for testing agricultural tractors. It will have two new engine test beds, as well as an overhaul bay.

## India's Largest Refinery On Stream

The Trombay Island, Bombay, refinery of Burmah-Shell Refineries Ltd., India's largest refinery, came on stream in February with a capacity of 2,000,000 tons of crude per annum.

The refinery will process Middle East crude, and will be capable of supplying nearly half of India's requirements of petroleum products, including gasoline, kerosine, diesel oils, furnace fuels and bitumen. The complete plant, including a catalytic cracking plant and a bitumen unit, will be in full operation within the next few months.

## New President of Institute of Fuel

R. H. Gummer, a director of International Combustion Ltd. and associated companies, has been elected president of The Institute of Fuel. He will take office in October next, in succession to Dr. W. Idris Jones, director general of research to the National Coal Board, who has been president of the Institute since 1953. Mr. Gummer has been a member of council of the Institute since 1933, honorary treasurer since 1945 and a vice president since 1951. He has been well known for many years in engineering activities connected with fuel.

## First Well Spudded Off Qatar

A rig capable of drilling to about 7,000 feet began boring into the sea bed of the Persian Gulf early in February from a 1,900-ton movable platform of steel five miles from the Qatar shore.

The concession for this exploration was acquired by Shell from the ruler of Qatar at the end of 1952. At that time exploration rights were granted over a large area of the Persian Gulf extending beyond the territorial waters of this independent Sheikhdom lying on the eastern coastline of Arabia. Preliminary surveys have resulted in the selection of this first drilling location on which the £500,000 movable island, completed in the past seven months, has been set up.

The design of the platform is based on lessons learned by Shell in underwater drilling in Lake Maracaibo, in the Gulf of Mexico and in the South China Sea off Borneo.

## Shell Films

The Royal Dutch/Shell group of companies have produced a series of films of outstanding interest to the petroleum industry.

The technical accuracy of these films is ensured by the participation of the geological and production department of N. V. de Bataafsche Petroleum Maatschappij, and most of the photography was carried out in Southern and Central Sumatra, Kalimantan (Borneo) and Java, while some additional material was shot in Europe, the Middle East and Venezuela.

Three films have been produced. They are "The Changing Earth," "The Search for Oil," and "The Wildcat," while a fourth, "The Oilfield," is in course of production.

"The Changing Earth" shows how the action of natural forces causes rocks to crumble and how sediments have been transported into marine areas and have accumulated there as rock formations. It shows how in certain conditions marine organisms can be trapped within the strata and, after undergoing change, become oil and oil gas.

"The Search for Oil" is set mainly in the jungles of Indonesia, and the film gives a vivid picture of the laborious and costly processes involved in the search, all of which are necessary before drilling begins. Aerial photography provides the basis for maps which must be built up before ground exploration can begin.

"The Wildcat" is a film showing the drilling of a well from spudding in to striking oil, vividly showing the hard and continuous work involved in this part of the petroleum engineer's life.

## Personnel

Sir William Fraser, chairman of British Petroleum Co. Ltd., on whom a barony was conferred in the New Year Honours List, has chosen the title of Lord Strathalmond of Pumpherston, in the County of Midlothian. The title recalls his family connection with the Scottish shale oil industry, in which he and his father before him have been engaged. The river Almond flows through the Scottish shale fields and "Strath" is a Gaelic derivative meaning "valley."

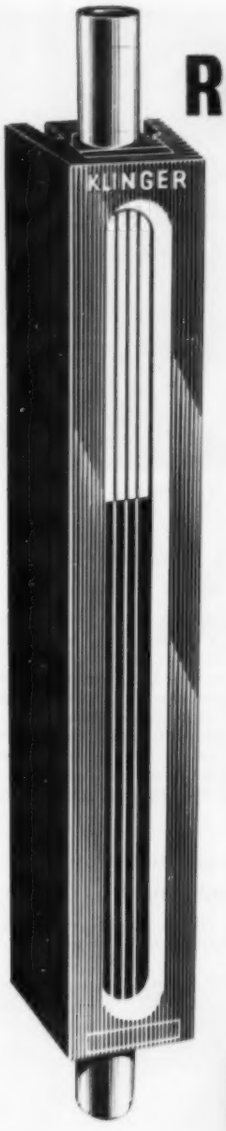
Dr. P. E. Kent, a senior geologist of British Petroleum, has been awarded the Bigsby Medal by the Council of the Geological Society, "for contributions to the palaeogeography and stratigraphy of England and Wales, and his researches in Central Africa and Persia." The medal was founded by Dr. J. J. Bigsby, a Canadian geologist who died toward the end of the last century. A qualification is that the recipient must not be older than 45.

## Mobile Drilling Rigs

Scammell Lorries Ltd. and Woodfield Hoist and Associated Industries Ltd. of Rochester, Kent, have developed a mobile oil well drilling and servicing unit, using a Scammell "Constructor" 21 feet 9 inches wheel base machine carrying a Woodfield W7 Mark II with the Ideco Woodfield telescoping mast. The rig is intended for servicing or drilling to a nominal depth of 7,000 feet, and the drive to the drawworks is taken from a mid-bed mounted Rolls Royce C6 NFL diesel engine, a unit similar to that powering the truck, thus reducing the number of spares required.

Machines are at present in production to the order of Shell for use in Venezuela and Seria, British Borneo.

# Reliability and Readability

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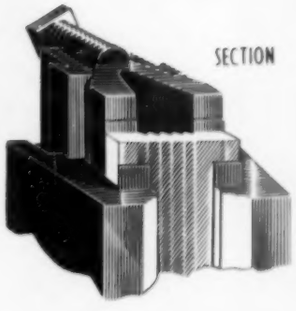


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## Million Feet Drilled In Search For British Oil

This year, British Petroleum enters its twentieth year of seeking and producing oil in Great Britain. Since exploration was started in 1936, more than one million feet have been drilled by the company.

By the end of last year, 507 wells had been drilled in various parts of the country, mostly in the Midlands, and at the present time about 230 wells are producing, 1954 production being about 59,000 tons of crude.

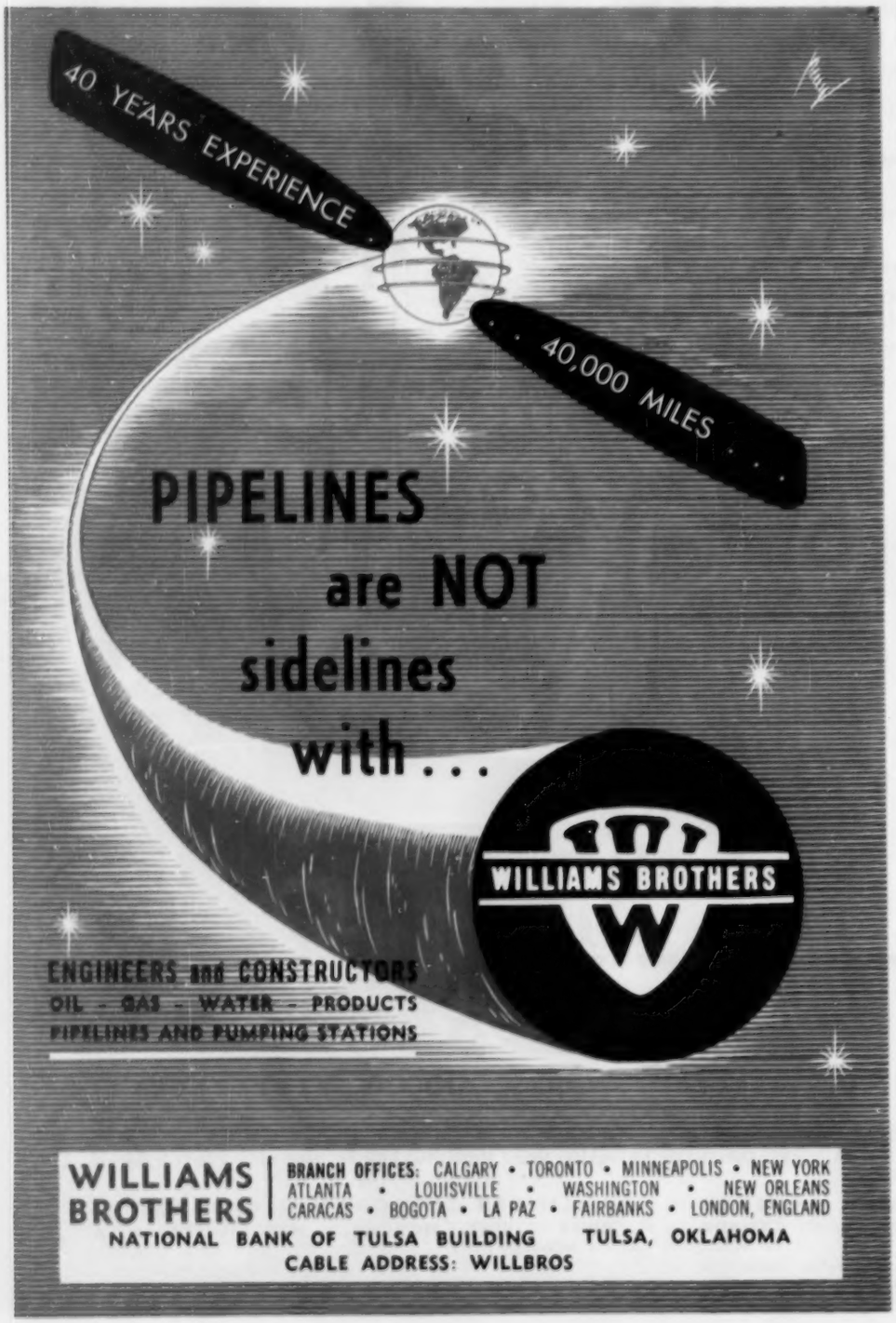
The newest oilfield, the most important find since the war, is at Plungar, Leicester, where oil was first found in October 1953. Eight wells have been sunk in this field, three of which are producers. The ninth began drilling in February and preparations are being made to put down two more.

## Society Of Engineers

C. R. Young, assistant to the refinery manager at the Esso refinery, Fawley, is this year's winner of the Society of Engineers' Bessemer Award for one of the outstanding papers presented to the Society during 1954. Mr. Young's talk, "Progress in Petroleum Refining," was delivered at Burlington House on March 1, 1954.

Mr. Young, an honors graduate (chemistry) of London University, has been in the oil industry for 33 years, having had experience in Persia and Romania prior to joining his present company in 1941. After service with the Petroleum Warfare Department and the Petroleum Board, he went to the Esso refinery as process superintendent in 1946, and was appointed assistant general refinery superintendent in 1948, prior to taking up his present appointment in 1951.

*C. R. Young*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## Fluor, Head Wrightson Plan Australian Plant

As part of the program to increase the supply of gas to the city of Melbourne, Australia, a gas dehydration plant has been designed by Head Wrightson Processes Ltd., British affiliate of the Fluor Corp., with the technical assistance of Fluor. The new super-plant, scheduled for completion in mid-1955, will dehydrate 18,000,000 cubic feet of gas daily. Located at Morwell, 50 miles from Melbourne, the unit will process gas extracted from the brown coal deposits nearby.

## United Kingdom Refinery Throughputs Up

The four refineries (Kent, Llandarcy, Grangemouth and Pumpherston) operated in the United Kingdom by The British Petroleum Co. last year processed nearly nine million barrels more oil than in 1953. The provisional throughput of the four refineries for 1954 was 77,000,000 barrels, compared with 68,100,000 barrels in 1953 and 49,500,000 barrels in 1952.

## Underwater Seismic Survey

Results of the underwater seismic survey at present being conducted in the waters off Abu Dhabi and Dubai in the Persian Gulf are now being examined in London. The survey is being carried out on behalf of the British Petroleum Company and Compagnie Française des Petroles who jointly have rights over these areas. Over 8,000 seismic records have so far been taken in the survey which began December 1954 and is expected to take about four months altogether.

The survey is being conducted by Geomarine Service International from the vessel "Sonic," and follows a geological and gravity survey carried out in this area earlier last year.

## Lafarge Revolving Refractory Chart

The ability to substitute large monolithic units for the customary brick by brick construction, and the ease with which intricate special shapes can be quickly made or awkward corners filled up, has made the use of cold-setting refractories almost universal practice for a variety of jobs. Some users make up their own refractory concrete from mixtures of aluminous cement and crushed firebricks or grog, while others prefer to use one of the proprietary cold-setting premixes.

To help firms making their own mixtures to be certain that the right mix is being used, the Lafarge Aluminous Cement Co. Ltd. has produced a revolving refractory chart which shows at a glance the various uses for refractory concrete, the most suitable aggregate, suggested mixes and also the hot face temperatures which such mixtures should withstand.

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# OIL COMPANY STAFF CHANGES

**JOHN A. SCOTT** has been elected president of Sinclair Chemicals, Inc., petrochemical subsidiary of Sinclair Oil Corp. Mr. Scott has been executive vice president and a director of Sinclair Chemicals since its organization in 1952 and a member of the Sinclair organization since 1934. First employed as a research technologist with Sinclair Refining Co. in Chicago, he has held a number of important research positions and from 1945 to 1951 served as assistant to the vice president in charge of research and development in New York. When the petrochemicals division of Sinclair Refining Co. was formed in 1951, Mr. Scott was named manager of the division, advancing to his recent position with the establishment of the petrochemicals subsidiary of Sinclair Oil Corp. a year later.

*J. A. Scott*

**E. E. MAYO** has been appointed vice president of the recently organized Southern Pacific Pipe Lines Inc.

Mr. Mayo has been chief engineer since 1944 of Southern Pacific's Pacific lines west of El Paso. The pipe lines of the newly formed company will carry refined petroleum products from the Los Angeles and El Paso refinery areas to Tucson and Phoenix, Ariz., covering a total of about 800 miles.

**FRANK C. OSMENT** has been named assistant chief geologist, programs, for Stanolind Oil and Gas Co. He has been division geologist in the company's Texas-Louisiana Gulf Coast division for the past three and one-half years.

**G. A. KELLENBERG** has been elected comptroller of the Arabian American Oil Co. Mr. Kellenberg, who was assistant comptroller, has been with Aramco and affiliated companies for 25 years. He will make his headquarters in Dhahran, Saudi Arabia.

*G. A. Kellenberg*

**RAYMOND F. KELLER,** general manager of Canadian operations, has been appointed a vice president of General Geophysical Co.

Mr. Keller, a graduate of the Colorado School of Mines, was first employed by General Geophysical as second computer in 1941 and was promoted to party chief in January 1944. His promotion to supervisor came in August 1949, when he took charge of General's Canadian department.

His residence will remain in Edmonton, Alberta, where General maintains its Canadian headquarters office.

*R. F. Keller*

**GLEN B. GARIEPY** has been appointed chief geologist for The Ohio Oil Co., effective April 1, according to W. B. Emery, vice president of production.

Mr. Gariepy succeeds Paul L. Henderson, who has been elected a director and vice president of production. R. M. Wilson will succeed Mr. Gariepy as assistant manager of the company's Shreveport, La. production division.

*G. B. Gariepy*

*R. M. Wilson*

**CHARLES F. HUNKINS** of California is the new manager of geology and engineering of the oil development department of the Northern Pacific Railway Co.

Mr. Hunkins, a petroleum engineering graduate of the University of California, had been district superintendent for an important independent producing company in Bakersfield, Calif. before joining Northern Pacific as chief petroleum engineer in October 1952.

**H. W. BROWN,** Tulsa, who began his oil industry career 26 years ago as seismograph operator, has been elected a director of The Carter Oil Co. He succeeds Nelson Y. Ruth, who became an assistant coordinator of the producing-coordination group of The Standard Oil Co. (N.J.) this month.

Mr. Brown has been manager of the Carter exploration department since September 1, 1953. Merrill W. Haas, chief geologist for Carter since 1951, succeeds him as exploration manager.

Mr. Brown joined Humble Oil and Refining Co. in 1928 and transferred to Carter as seismograph party chief in 1935. He became assistant chief geophysicist in the Tulsa office in 1949 and served as chief geophysicist from September 1, 1952, until he was made exploration manager last year.

Mr. Haas had worked in the geology department of the Humble Oil and Refining Co., Lago Petroleum, Creole Petroleum and Standard Oil Co. (N.J.) before joining the Carter geology staff September 1, 1950.

**WILLIAM I. BURT,** vice president-manufacturing of B. F. Goodrich Chemical Co., has been elected president of Goodrich-Gulf Chemicals, Inc., a company owned half by the B. F. Goodrich Co. and half by the Gulf Oil Corp. The company is seeking to purchase an undivided half interest in the government-owned butadiene plant at Port Neches, Texas, as well as a copolymer plant in the area. If these properties are acquired, the company will begin making synthetic rubber of a type used in automobile tires and other principal rubber products.

**J. P. EDWARDS,** executive secretary of Tide Water Associated Oil Co., retired December 31 after completing nearly four decades of service with the company. He was appointed assistant secretary of Associated Oil Co., Tide Water's predecessor firm, in San Francisco in 1916. In 1929 he became Associated's corporate secretary. He also served as assistant to the president of Tide Water Associated, and has been executive secretary of the latter firm since 1936.

**WILLIAM B. CLEVELAND** has been named manager of the marketing department of Creole Petroleum Corp. in Caracas, Venezuela, replacing D. S. Skeie, who is retiring. Mr. Cleveland has been succeeded as assistant manager by Lionel J. Bourgeois.

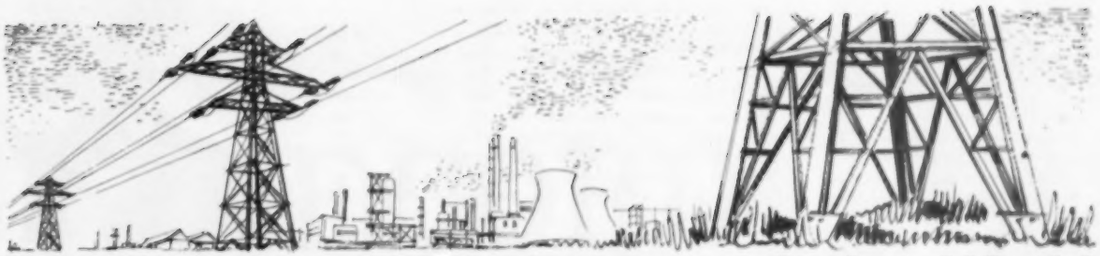
Mr. Cleveland, a petroleum engineer who has been with Creole for 17 years, first went to Venezuela in 1938 with Creole's predecessor, the Lago Petroleum Corp.

Mr. Bourgeois joined Lago in July 1937 and before his recent appointment had been manager of the operations section in the company's Caracas marketing department.

Other appointments in Creole's marketing department included Carlos M. Creamer, manager of the operations section, and H. Clifford Carroll, Jr., new manager of the sales section. Alfredo Echeverria will become assistant manager of the sales section.

*W. B. Cleveland*

*L. J. Bourgeois*



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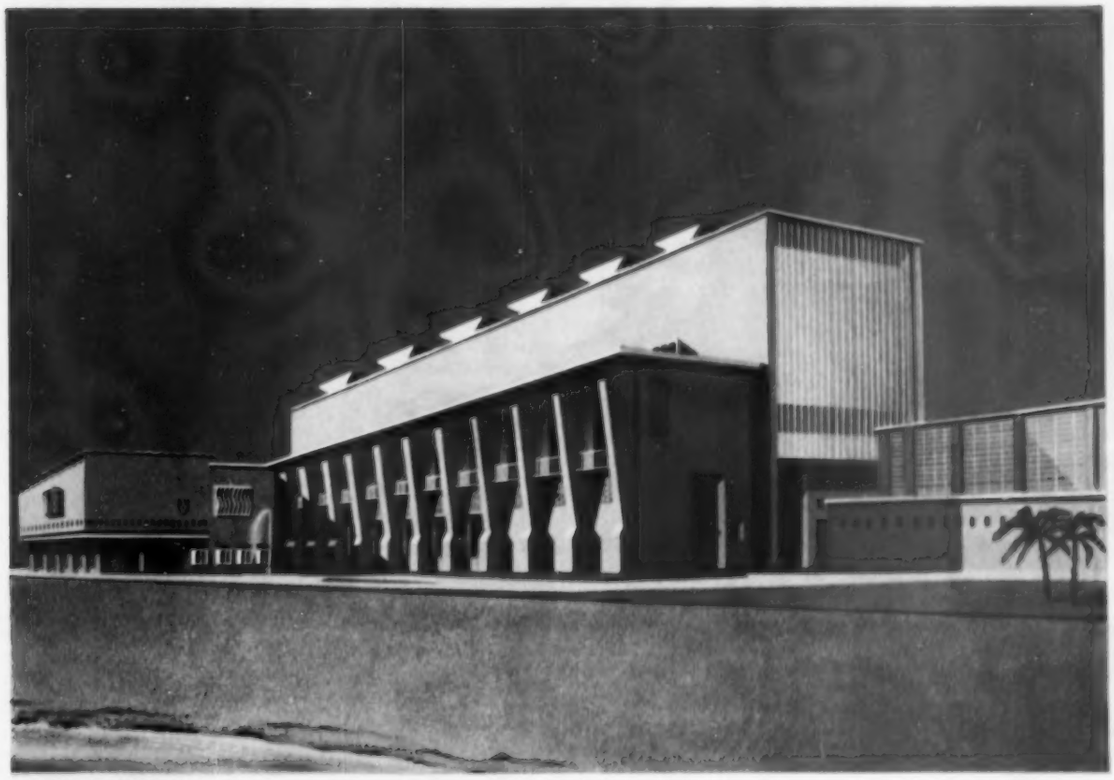

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**GRAHAM B. MOODY,** chief reserves engineer on the executive staff of Standard Oil Co. of Calif., retired from the company effective November 30 after 34 years of service. Widely experienced in field geology, Mr. Moody served Standard in the Philippines, Mexico and a major portion of the southwestern United States. He was named senior reserves engineer in 1944 and chief reserves engineer in 1951. In the latter capacity, he functioned as consultant to engineers of wholly-owned subsidiaries and the parent company.

**JAMES W. HENNET** has been named export advertising supervisor for the eastern division of Tide Water Associated Oil Co.

Mr. Hennet, who joined the company in 1947, held various positions in the divisional advertising department until 1951, when he was named export advertising assistant, the post he held until his recent promotion.

**JOHN O. RUNDLE** has been elected vice president in charge of operations of Loffland Brothers to succeeed B. B. Smith, deceased. Mr. Rundle now is vice president in charge of operations of Loffland's Venezuelan and Peruvian companies. He will continue in charge of all foreign subsidiaries including Loffland Brothers of Canada, in addition to assuming his added duties with the parent company. He will move to Tulsa from Venezuela.

During the time Mr. Rundle was in charge in Venezuela the company drilled the Alturitas No. 2 for Creole Petroleum Corp. to a depth of 17,365 feet, the deepest hole ever drilled in that country. He was also in charge during the recent drilling operation in Colombia where the Buchado No. 1 for Richmond Oil Co. was drilled in western Colombia to a depth of 15,385 feet, which is the deepest hole drilled in Colombia.

*J. O. Rundle*


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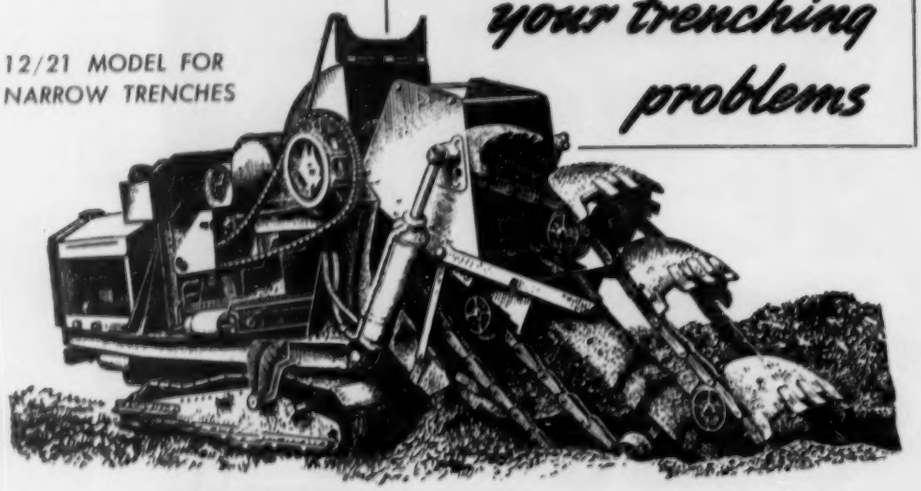

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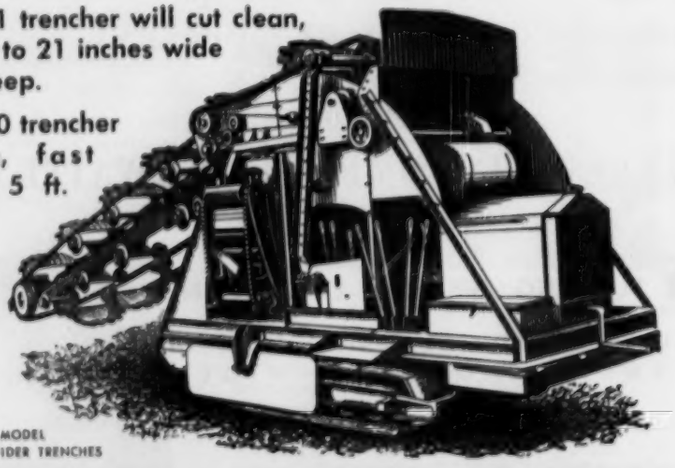

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**M. E. SCHWARZ,** vice president and manager of the mid-continent division of Seaboard Oil Co., has been placed in charge of all of Seaboard's field operations and appointed assistant to the executive vice president in Dallas. J. W. Rawley, assistant manager of the division, has been elected a vice president and division manager.

J. M. Clayton, co-ordinator of the geological and geophysical departments in the mid-continent division, will assume this title for all company operations. H. H. Lawson, manager of the land department in the western division, will become assistant to the vice president and manager of the western division with headquarters in Denver. R. M. Bischoff, administrative assistant to the executive vice president in Dallas, is being transferred to the western division at Denver to be assistant manager of production. E. R. Smith, district production superintendent of the California district, Los Angeles, is being transferred to the mid-continent division, Dallas, as reservoir engineer. J. N. Conley, regional geologist in the Abilene district, is being transferred to Denver as chief geologist of the western division.

**K. S. ANDREA,** assistant superintendent of Continental Oil Company's Billings, Mont., refinery, has been promoted to assistant to the vice president in charge of manufacturing. He succeeds C. B. Round, recently promoted to assistant superintendent of Conoco's largest refinery at Ponca City.

Harold G. Owen, Houston, Texas, staff engineer in Continental's petrochemical department, succeeds Mr. Andrea at Billings.

Other promotions announced in Continental's manufacturing department include that of Lester H. Zarnes, former assistant superintendent in charge of the mechanical division at Conoco's Ponca City refinery, to assistant superintendent in charge of the thermal and catalytic cracking division there. He succeeds A. R. Guest, resigned.

**CLAUD B. BARRETT,** vice president-sales, has been named vice president for The Texas Co. at Houston, and S. C. Bartlett, general sales manager, has been elected vice president to succeed Mr. Barrett effective March 1.

Mr. Barrett succeeds George R. Bryant, who resigned his position as vice president on February 1 to become president of the Jefferson Chemical Co., Inc., owned jointly by The Texas Co. and American Cyanamid Co.

**J. HERBERT SAWYER** has resigned his position as eastern division geologist of Creole Petroleum Corp. at Caripito, Venezuela, to become exploration manager of Esso Standard Oil, S.A. at Havana, Cuba. The change became effective March 1. Mr. Sawyer's address will be: Esso Standard Oil, S.A., Apartado, 4087. Havana, Cuba. P. P. Wolcott succeeds Mr. Sawyer in Eastern Venezuela.

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# CANADA

*B. E. Lowe*

## Appointed Trans-Canada Sales Manager

The appointment of B. E. Lowe as manager of sales for Trans-Canada Pipe Lines Ltd. is announced by N. E. Tanner, president of the pipe line company. Mr. Lowe will be located at Trans-Canada's sales headquarters in Toronto.

Under A. P. Craig, vice president in charge of sales, Mr. Lowe and J. W. Tomlinson, whose appointment as assistant sales manager was announced last month, will negotiate contracts with natural gas distributors and with large industrial users of natural gas which are located outside the territories served by the distributors. His sales responsibilities will cover the entire Trans-Canada Pipe Lines' natural gas transmission network linking the Alberta gas fields and Montreal.

## Named to International Petroleum Post

International Petroleum Company Ltd., affiliate of Standard Oil Co. (N.J.), has announced the election of Ivan R. Cunningham as a director and vice president, effective January 1, 1955, replacing Paul W. Lambright.

Mr. Cunningham went to work for Standard Oil Co. of Venezuela in Maracaibo in 1924. That company was the predecessor of the Creole Petroleum Corp., of which Mr. Cunningham became comptroller in 1945 and a director in 1948. In 1953, he joined the staff of the producing coordination department of Standard Oil Co. (N.J.) in New York, and was appointed assistant coordinator the following year. He has been concerned chiefly with the financial, accounting, and administrative aspects of the oil business.

## Hudson's Bay Appoints Whiteside

F. C. Whiteside, for the past five years an executive of Continental Pipe Line Co., Ponca City, Okla., has been appointed manager of pipe line operations and crude oil sales for Hudson's Bay Oil and Gas Co. with headquarters in Calgary, it has been announced by R. C. Brown, president of the Canadian company. Both companies are affiliates of Continental Oil Co.

Mr. Whiteside joined Continental Pipe Line in 1950 as chief engineer, following service with other transmission firms. He held a succession of positions with the company before his promotion to manager of development and technical advisor to the president.

## Calgary Group Elects Officers

At a recent meeting of the Calgary chapter of the Oilfield Technical Society, L. C. Stevens of Socony-Vacuum Exploration Co. was elected president for 1955 with D. A. Schmeeckle of Shell Oil Co. as vice president. D. T. Magee of California Standard Co. was elected secretary and E. E. Cudby of California Standard was elected treasurer.

The program committee, under the chairmanship of R. F. Cummer of McColl-Frontenac Oil Co. Ltd., consists of J. Menneer of Anglo-American Exploration Ltd., C. W. Daniel of Shell Oil Co., J. Peach of Commonwealth Drilling Co. and A . T. Tidwell of Oil Well Supply.

The Oilfield Technical Society is a Canadian organization which started in Calgary approximately five years ago. Another chapter was subsequently formed in Edmonton and the possibilities of creating a third chapter in Regina are presently under review. The general purpose of the society is to acquaint members at its regular monthly meetings with the various technical and non-technical aspects of the oil industry. Its membership is open to any man employed in the industry.

*Officers for 1955 elected at a recent meeting of the Calgary chapter of the Oilfield Technical Society are, left to right, front row: D. T. Magee secretary; D. A. Schmeeckle, vice president; L. C. Stevens, president; and E. E. Cudby, treasurer. Left to right, back row, are the members of the program committee: R. F. Cummer, chairman; J. Menneer; C. W. Daniel; J. Peach; and A. T. Tidwell.*

## Trans-Canada Contracts for Gas

The first natural gas supply contracts have been signed by Trans-Canada Pipe Lines Ltd. and three major Alberta gas producers. Contracts calling for the purchase of more than 125 million cubic feet daily have been signed by Trans-Canada with Hudson's Bay Oil and Gas Co. Ltd., Canadian Delhi Oils Ltd., and Canadian Export Gas Ltd. and Associates.

N. E. Tanner, president of Trans-Canada, said that the gas now contracted for represents one-quarter of the capacity of the 2,300-mile pipe line, and is sufficient to meet the needs of the pipe line for the first year of operation. The first year's operation is scheduled to bring natural gas service to Winnipeg and the Northern Natural Gas Co., which will serve areas in the U. S. from Trans-Canada's lateral line between Winnipeg and Emerson, Manitoba.

## Made Sun Regional Office Manager

Appointment of Frank R. Forsey as regional office manager for Sun Oil Co. Ltd. has been announced by Donald P. Jones, comptroller.

Mr. Forsey succeeds James W. Cole, who has been transferred to a special assignment.

Formerly departmental supervisor at Toronto, Mr. Forsey joined the company in 1934.

## Timken to Build Rock Bit Plant in Canada

The Timken Roller Bearing Co. has announced plans to construct a rock bit producing facility at its St. Thomas, Ontario plant. Steel for the necessary building addition will be ordered immediately, with construction scheduled to get underway in six or eight weeks. It is estimated rock bit production will get started around September 1955. The new building addition will contain 5,600 square feet of floor space. Cost of the building and equipment is estimated at about $250,000.

Carbide insert rock bits will be produced at the St. Thomas plant in sizes up to three inches in diameter for the expanding Canadian markets and export trade.

The St. Thomas rock bit plant will be a finishing operation with the forgings supplied from the Wooster steel mill.

## Canadian Oil Companies to Add Production Department

Wallace M. Luthy has joined the Canadian Oil Companies Ltd. to head up and organize a production department with headquarters at Calgary, Alberta. Mr. Luthy has been associated with crude oil production and supply for the past 20 years. He was previously crude oil supply manager of the Ashland Oil and Refining Co. of Ashland, Kentucky. "It is management's objective to make the company fully integrated and keep it Canadian-owned," W. Harold Rea, company president, said. Oil production has been the only missing link in this program. "We intend to allocate some of our resources for this purpose because in so doing we hope to strengthen the long term position of the company and contribute to the development of our national economy. What form our entry into production will take, to a great extent, will depend on Mr. Luthy's recommendations after he has had an opportunity to survey the situation in Western Canada," he said.

Incorporated in 1908, and with more than 98 percent of the shares Canadian-owned, Canadian Oil Companies Ltd. has been primarily a marketing company. The company now markets its products through more than 3,000 outlets in all provinces except British Columbia and Newfoundland.

Two years ago the company built an ultra-modern refinery at Sarnia, Ont., currently running 22,000 barrels a day. It is to be increased to 30,000 barrels a day by 1957.

*W. M. Luthy*

## United States and Canadian Reserves Higher

United States and Canadian reserves of crude petroleum rose substantially in 1954, according to estimates prepared by committees of the Canadian Petroleum Association and of the American Petroleum Institute. Natural gas liquids reserves in the United States declined for the first time in recent years, but natural gas reserves continued to climb, the American Gas Association estimated. In Canada natural gas liquids reserves were higher at the end of the year.

In the United States crude reserves increased 616 million barrels to 29,561 million barrels. Year and reserves were 13 times as great as 1954 production.

In Canada crude reserves rose 362 million barrels to 2,208 million. Year end reserves were equal to 22 years of production at the 1954 rate.

Natural gas liquids in Canada rose 10 million barrels to 208 million, while in the United States there was a drop of 193 million barrels to 5,244 million barrels.

Natural gas reserves are not estimated by the CPA committee, but the reserves committee of the American Gas Association has indicated a rise of 263,600 million cubic feet in the United States to 211,710,732 million cubic feet.

Significant reductions in crude reserves in California and Texas were reported by the API committee. California reserves were down 31 million barrels to 3,889 million and Texas reserves 17 million to 14,982 million barrels. Texas reserves were lower in percentage of the national total and in volume than three years ago at the close of 1951. At that time Texas had 15,315 million barrels, or 55.7 percent of the U. S. total. At the end of 1954 Texas' percentage of the national total was 50.7.

Oklahoma, with an increase of 203 million barrels, and Louisiana, with 202 million, were the largest gainers in reserves. Kansas and Mississippi in the Midcontinent followed with 65 and 62 million barrel gains.

Rocky Mountain states showed nice increases again. Montana reserves rose 63 million barrels, Wyoming 24 million and Colorado nine million.

In the case of natural gas liquids, Texas lost 339 million barrels. Lousiana, with an increase of 71 million, and Oklahoma, with 30 million barrels, were the largest gainers.

Alberta crude reserves increased 304 million barrels in 1954. Saskatchewan 40 million and Manitoba 18 million barrels. All of the increase in natural gas liquids was centered in Alberta and northern British Columbia.

**U. S. RESERVES**

**Liquid Hydrocarbons (Thousands of Barrels)**

| COMMODITY | 12/31/53 | 12/31/54 | INCREASE OVER 1953 |
|---|---|---|---|
| Crude Oil .... | 28,944,828 | 29,560,746 | 615,918 |
| Natural Gas Liquids .... | 5,437,922 | 5,244,457 | –193,465 |
| Total Liquids . | 34,382,750 | 34,805,203 | 422,453 |

**Natural Gas (Millions of Cubic Feet)**

| | | | |
|---|---|---|---|
| Natural Gas . | 211,447,132 | 211,710,732 | 263,600 |

**CANADIAN RESERVES**

**Liquid Hydrocarbons (Thousands of Barrels)**

| COMMODITY | 12/31/53 | 12/31/54 | INCREASE OVER 1953 |
|---|---|---|---|
| Crude Oil .... | 1,835,422 | 2,207,614 | 362,192 |
| Natural Gas Liquids .... | 198,126 | 208,311 | 10,205 |
| Total Liquids . | 2,043,548 | 2,415,945 | 372,397 |

## Returns to Shell of Canada

M. A. Ross has returned to his position as controller of Shell Oil Co. of Canada Ltd. Appointed controller in 1945, Mr. Ross has spent the last two years in the United Kingdom and the United States on special assignments for Shell. He resumes his post at the Canadian company's head office in Toronto.


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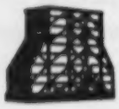

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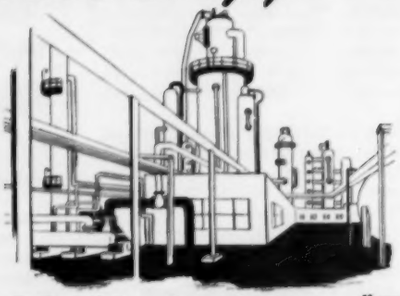

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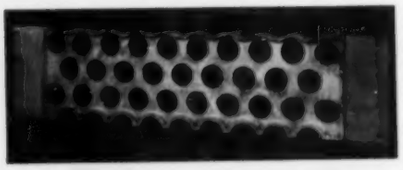

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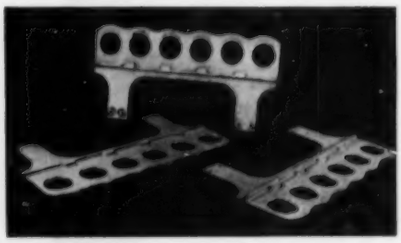

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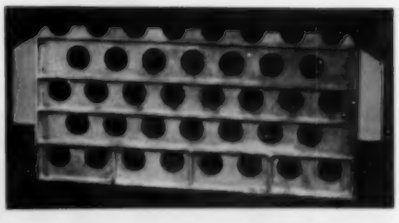

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## New AAPG President

Newly elected president of the American Association of Petroleum Geologists is veteran oil man G. M. Knebel. Mr. Knebel, manager of exploration for Standard Oil Company (N.J.) and president of Esso Standard (Turkey) Inc., a Middle East affiliate, succeeds Edward A. Koester, consulting geologist of Wichita, Kansas. Mr. Knebel was installed as president for a one year term at the Association's 40th annual meeting in New York, March 28-31. He joined the Jersey Standard organization in 1924 and served nine years as chief geologist of its Venezuelan affiliate before transferring to the company's producing department at New York in 1939.

## Armored Motors Bulletin

A new full-color, four-page publication describing armored motors (direct current types MD and MDP, 600 series) is available from the General Electric Co., Schenectady , N.Y.

Designated GEA-4654C, the bulletin provides information on performance and maintenance features of the heavy-duty G.E. motors. Included in the bulletin are horsepower ratings and mechanical data. Diagrams and photographs illustrate various applications of the armored motors in the steel, lumber, oil and construction industries.

## Ethyl Executive Named For Defense Post

John Blair Macauley, director of technical coordination for the Ethyl Corp., is the new Deputy Assistant Secretary of Defense. Mr. Macauley has served with the Packard Motor Co., Lincoln Motor Car Co., American Brake Shoe Co., and the Maxwell Motor Co., which later became the Chrysler Corp.

In 1943 he became chief of applied research for the Pratt-Whitney division of United Aircraft Corp., and since 1945 has been director of engineering research and director of technical coordination with Ethyl.

## Du Pont Enlarges Service Staff

The petroleum chemicals division of the du Pont Co. has established a new sales section and a new technical service group to prepare for developments in the field of petroleum additives and to improve world-wide customer service. New sales districts also have been formed in Philadelphia and in Detroit.

The new additives sales group, headquartered in Wilmington, will be headed by R. M. Glover, formerly manager of the division's mid-continent region. The technical service group will operate from the petroleum laboratory at Deepwater Point, N.J. under the direction of W. E. Bettoney, formerly an assistant technical manager at Wilmington.

L. Z. Carey, formerly an eastern region sales representative, will manage the new Philadelphia district. P. H. Richard, one of the division's automotive experts, has been named manager of the Detroit district. D. W. Frison, formerly assistant manager of the mid-continent region, becomes the new manager of that region with offices in Tulsa. His assistant will be B. B. Russell, III, who has been the division's additives coordinator in Wilmington.

## Schwint Joins Davison

I. A. Schwint has joined the petroleum catalyst division, Davison Chemical Co. Division of W. R. Grace & Co., for sales and service contacts with petroleum refiners in parts of the eastern United States. He comes to Davison from the Filtrol Corp., for which he was eastern representative, and will have headquarters in Baltimore.

## New Catalyst Data

The Davison Chemical Co. Division of W. R. Grace & Co. has issued revised product data sheets on powdered and pelleted vanadia oxidation catalysts and on indicating silica gel for protective packaging. They are obtainable from the division's technical service department at Baltimore 3, Maryland.


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## World Crude Production

*(Continued from page 49)*

Year-end output was said to be up to 1,190,000 b/d. This year's Soviet program involves a further increase of 200,000 b/d to 1,400,000 b/d at the close of the year.

Much of the increase in output in the Middle East is due to a full quarter's operation of Iranian fields by the Consortium. Last year, under ten months of government operation, the fields produced 3,294,839 tons (23,205,518 barrels). In the final two months of the year output was about two million tons (15,300,000 barrels), according to official government reports. No statement was made as to whether the production figures included heavy oil returned to the formation. Early in the current year production was running at the rate of 230,000 b/d.

In Iraq, Basrah Petroleum Co. has begun commercial production from the Rumaila field near Zubair. A 20-mile line was laid to connect with the Zubair-Fao line to permit deliveries to the Persian Gulf. Current production rate is 8,000 b/d.

## New Research Laboratory

A new production research and development laboratory and a service building are being built by Sun Oil Co. on a 14½-acre tract at Richardson, Texas. Estimated cost of the overall project is $400,000. The new structures will supplant Sun's present laboratory at Dallas.

## Ohio Plans Denver Research Lab

The Ohio Oil Co. plans to build a petroleum research laboratory in the Denver area which will employ some 100 personnel, W. H. Barlow, manager, research department, announces. An 80-acre tract on South Broadway, 11 miles from downtown Denver, has been optioned.

## High Speed Gear Unit

The Philadelphia Gear Works, Inc. has developed a new line of Hi-Speed gear units for speed reduction and increaser service. These standardized units have been designed to operate at rotating speeds up to 9,000 rpm and pitch line velocities to 10,000 feet per minute can be accommodated without modification. Ratings up to 7,100 hp are available in any specified ratio from 1:1 up to 10:1.

## Buys Drilling Division

The contract drilling division of Southern Production Co. of Fort Worth has been purchased by the Offshore Co. of Baton Rouge, La., a subsidiary of Southern Production, for approximately $8,000,000. The sale involved 14 drilling rigs, nine of which are barge-mounted, related auxiliary equipment, warehouse stocks, transportation equipment and all of Southern Production's drilling contracts now in progress. The Offshore Co. holds exclusive rights to use the DeLong patents covering pneumatic jacking mechanisms employed in operation of portable deep-water drilling barges in the tidelands off the Gulf coast of the United States.

## Tide Water Expansion Plans

Tide Water Associated Oil Co. will spend more than $127 million during 1955 to step up its exploratory and development operations, expand its refineries and distribute improved products to its customers across the nation. This sum, according to President D. T. Staples, is the largest the company has ever budgeted for a single year's capital outlay. He indicated that in excess of $60 million will be allotted to refinery building and modernization. Much of this will be used to start construction of a major Flying A refinery on the eastern seaboard. Designed for a capacity of 130,000 barrels daily, the new plant will replace Tide Water's existing refinery at Bayonne, N.J.

## International Harvester Catalog

International power units ranging from 16.5 to 200 net horsepower are featured in a new 12-page catalog offered by International Harvester Export Co. Complete information is given on all 18 heavy duty engines in the IH line: five 4-cylinder carbureted power units, seven 6-cylinder carbureted power units, and six diesels in 4 and 6-cylinder models. Copies of the new catalog, in English, may be obtained from International Industrial Power dealers or by writing Merchandising Services Dept., International Harvester Export Co., 180 No. Michigan Ave., Chicago 1, Ill. Ask for catalog E-14E.

## Marchese Theodoli

Teodolo Theodoli, a veteran of the international oil industry and one of its most picturesque characters, passed away Jan. 21 at his home in Rome. He had been associated with American and Italian oil interests for more than 35 years.

An engineering graduate of the University of Rome, he was a commander of Italian mountain artillery in World War I and later went to Canada where he became a cowboy in Alberta. In 1919 he was sent to Port Arthur, Texas. The following year he was assigned to Italy, where he helped organize the Italian subsidiary of Texaco. In 1923, he was named managing director of the subsidiary, which became Caltex Oil Company (Italy) and formed part of the Caltex group after World War II.

In the postwar period, Mr. Theodoli took a major part in negotiations with Fiat leading to the formation of Petrolcaltex S.p.A., a marketing company, and SARPOM, which operates the Fiat-Caltex jointly owned refinery near Milan. He served as chairman of the board of both companies until 1954, and was a member of both boards at the time of his death. Surviving are his widow, Donna Elisabetta, and two sons.


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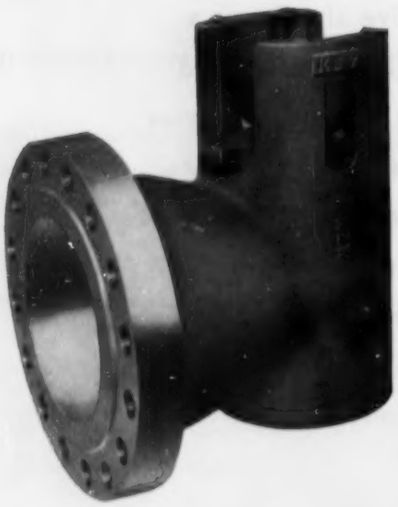

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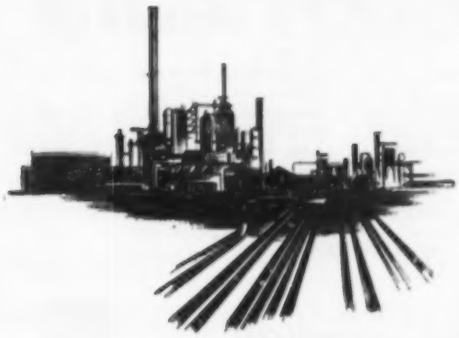

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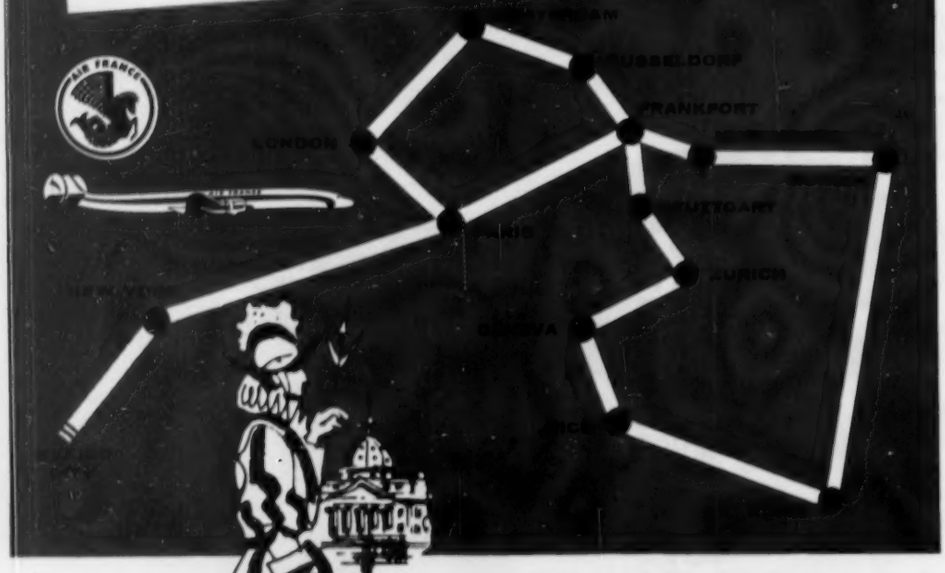


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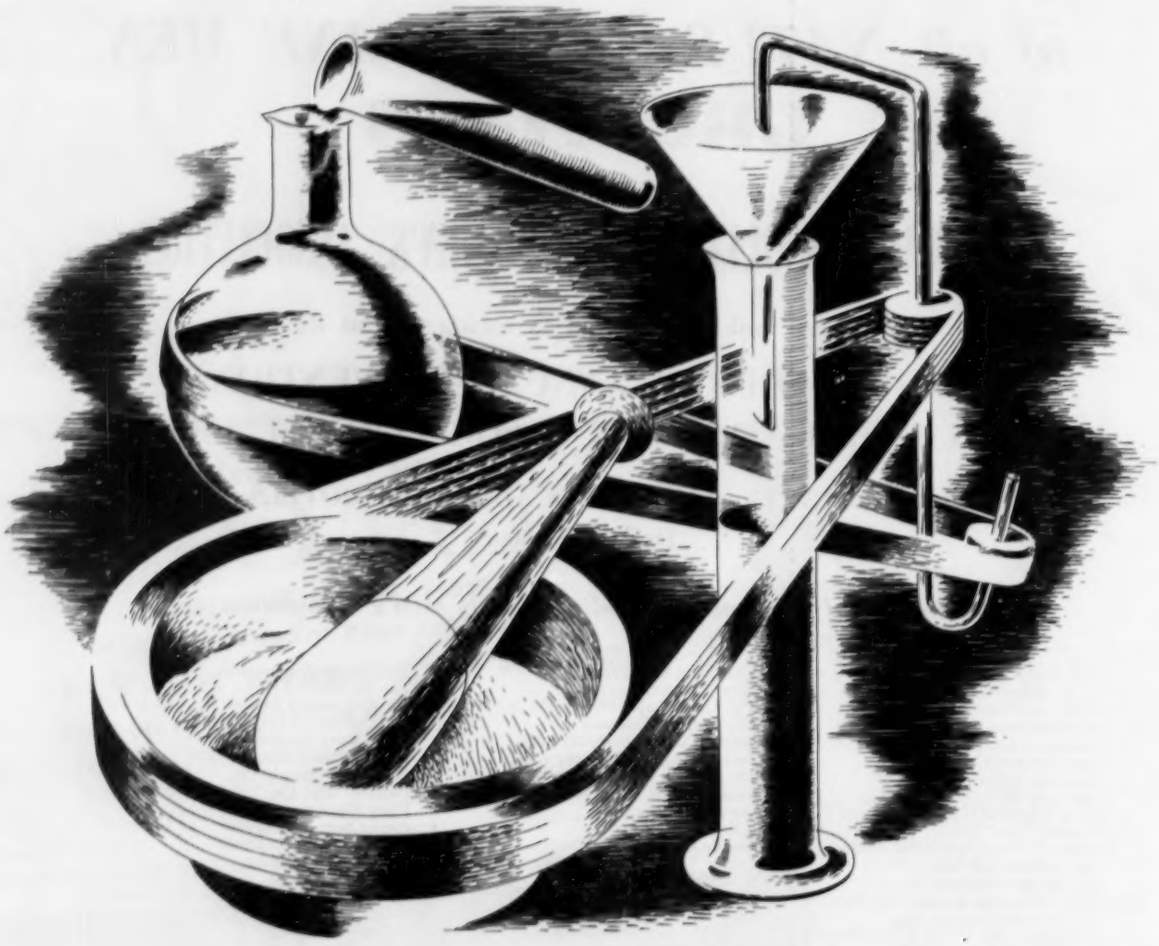

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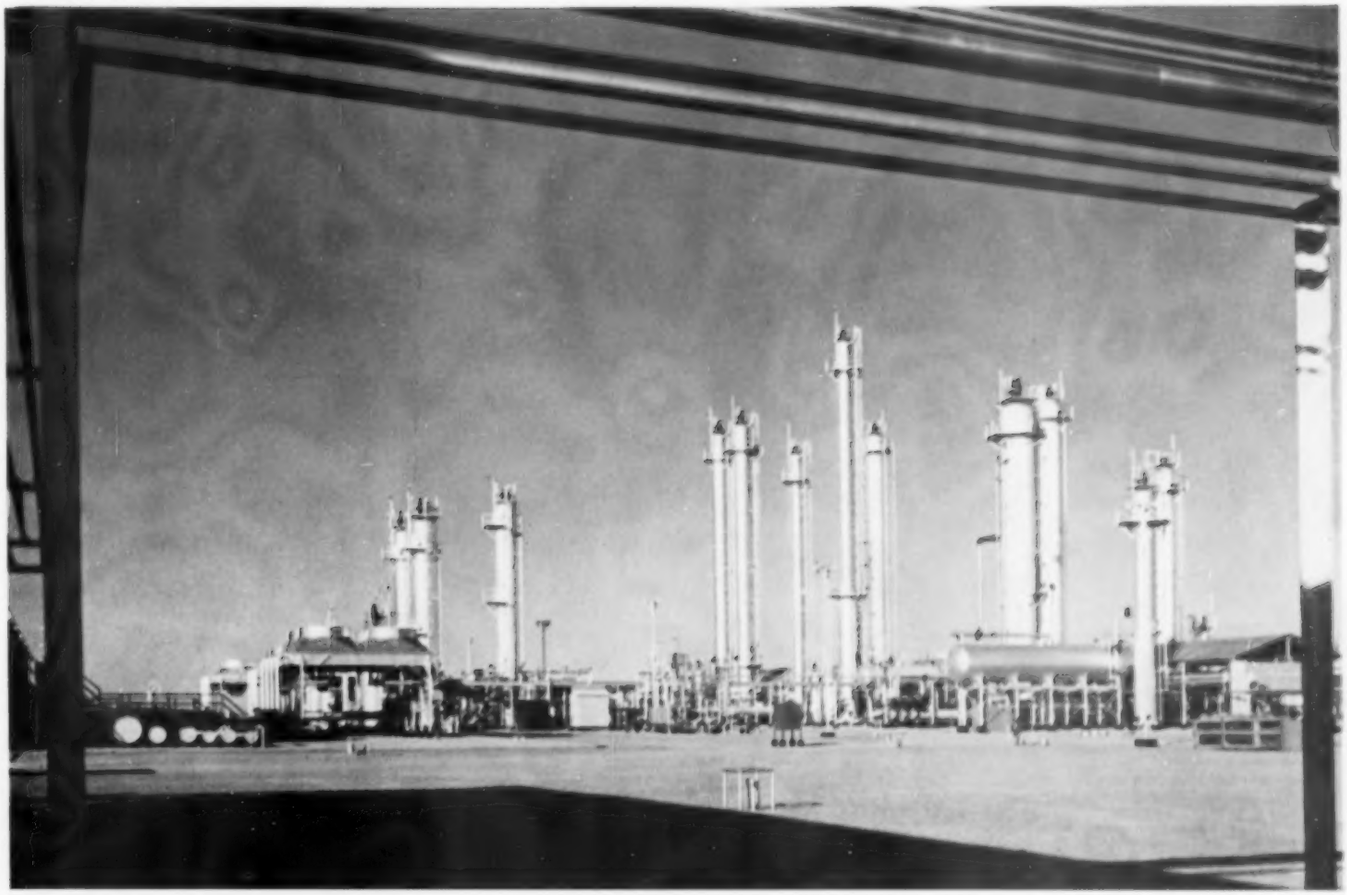

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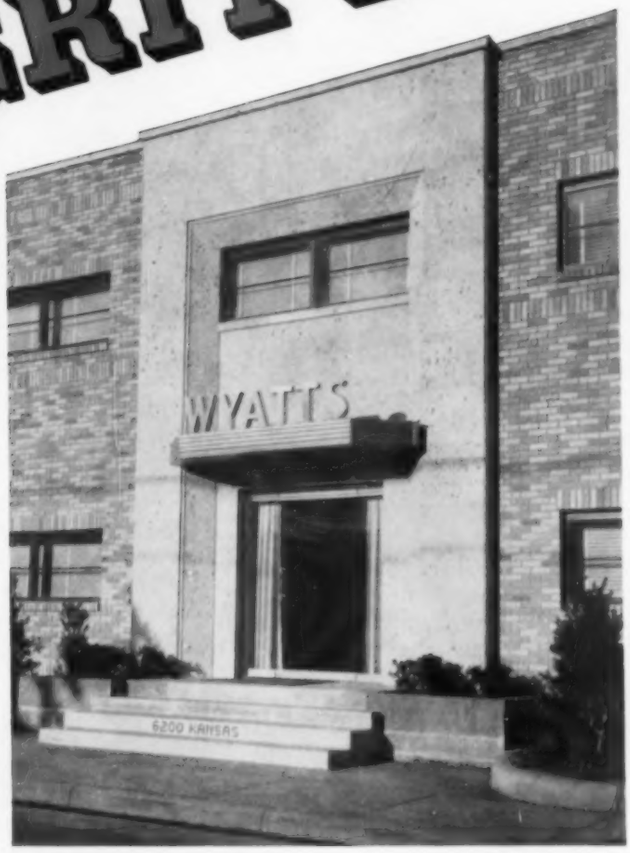


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